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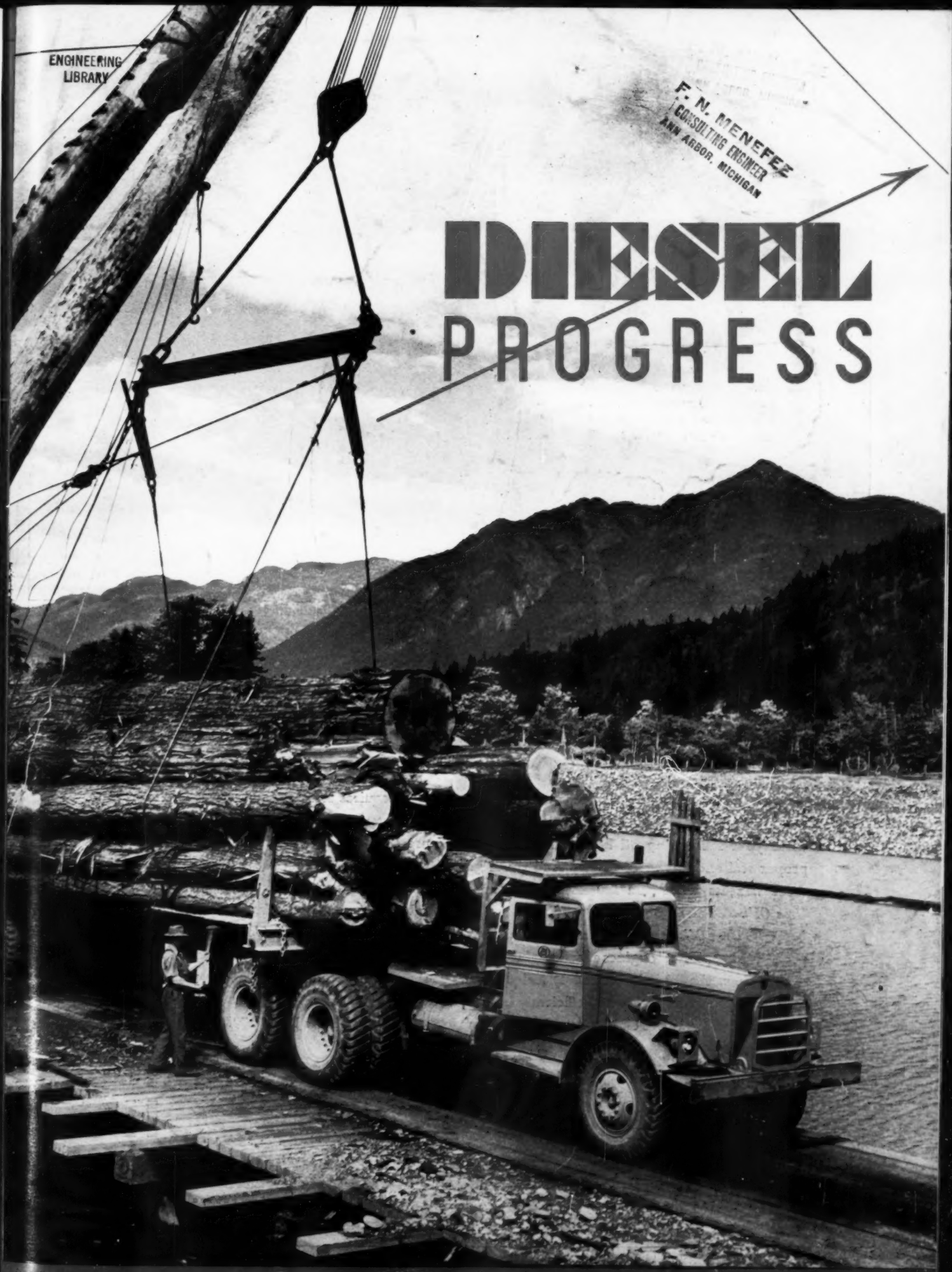
# DIESEL PROGRESS



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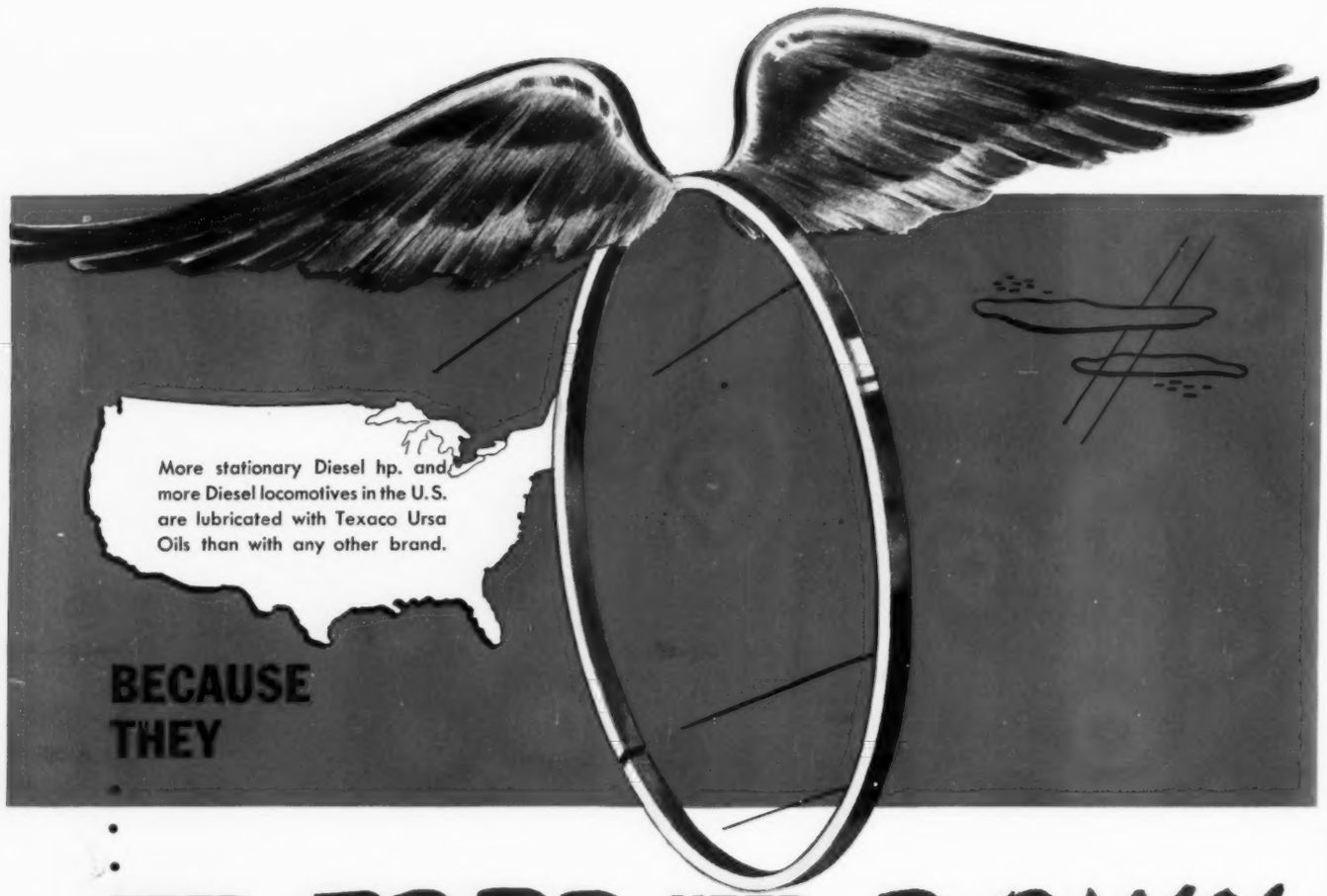
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# DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



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FRONT COVER ILLUSTRATION: Placing slings and removing stakes preparatory to unloading a semi-trailer hauled by a Kenworth tractor powered with a Cummins supercharged 275 hp. Diesel. Silver Skagit Logging Company is doing jobs with these trucks that make a piker of Paul Bunyan. Photo courtesy The Timberman.


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Two-unit, 3000 hp. American Locomotive freight Diesel recently delivered to Union Pacific. Forty of these units are now on order.

# UNION PACIFIC ORDERS 281,000 HP OF DIESEL MOTIVE POWER

## *World's Largest Diesel Locomotive Order Also Largest Locomotive Order Ever Placed*

*By* CHARLES F. A. MANN

Five more of these heavy-duty switch and road Diesels are on order from Fairbanks-Morse. These Diesels fill the power gap between switch and freight service.

DESPITE the fact that 90% of the U. S. and Canadian Railroads are glum and worried over the fantastic set of "Featherbed" operating and manning requirements demanded by the Railroad Unions—thinly disguised "Safety" measures that are merely direct thrusts against the modern age of "Unit" type motive power, the Union Pacific Railroad is plunging ahead with its Diesel program at an amazing pace.

In the August, 1946, issue of DIESEL PROGRESS, a glimpse and forecast of the Union Pacific Postwar program was given our readers. Fifteen months later, your Cab-riding Correspondent is pleased to report that not a single item, line, quantity or proposed improvement has been left out and the Union Pacific is setting America a brilliant example of the power of Private Enterprise at work, in our fine old Capitalistic Economy.

Under President George F. Ashby, Union Pacific is spending $110,000,000 to modernize its whole plant, and out of this huge sum of cash in the bank, nearly $26,000,000 goes for the biggest group of Motive Power orders ever placed in the history of the world, which is, most interesting of all, the biggest group of orders for Diesel Motive Power, multiplied by 6, ever placed in history!

America's pioneer transcontinental Diesel railroad operator, after a long interim of experimentation and superannuation of its once mighty steam power personnel, steps boldly out and begins by Dieselizing the entire 800 mile Los Angeles-Salt Lake segment of U. P. Mainline, in one huge swoop, so to speak.

Again we remind our readers that of all U. S. Railroads, none except possibly the Pennsylvania, has a finer, more modern fleet of excellent coal and oil burning steam locomotives to start with, than Union Pacific. Yet in spite of this, pressing, very obvious laws of operating economics dictate the replacement of steam on the Salt Lake-Los Angeles line.

"Youngest" of the four original integrated companies forming the Union Pacific System, the Los Angeles & Salt Lake Railroad was originally built to haul products of Montana mines and Wyoming coalfields to Los Angeles, along with grain and cattle, and semi-tropical fruits out of Southern California into the Intermountain country. That was before Oil and Tourists were discovered in Los Angeles. A single track Miners Dream, started by the late Capitalist Clark of Butte & Anaconda, this line was built on a pinch-penny basis, full of

President G. F. Ashby, President of the Union Pacific who is behind the railroad's 26 million dollar order for Diesel Motive Power.

5400 hp Electro-Motive Diesel with the crack Union Pacific "City of Los Angeles" in tow. 130,000 Diesel hp. will be delivered to U.P. under orders now outstanding with Electro-Motive.

6000 hp, 4-unit Alco freight locomotive heads out of Salt Lake with a string of loaded stock cars.

Union Pacific's "Los Angeles Limited" hauled by Fairbanks-Morse Diesel locomotive. It's the first opposed-piston job.

curves and political troubles with the Santa Fe. The first thing the U.P. did after picking it up was to rebuild the entire line and knock the politics out from under the Santa Fe opposition and boldly, at terrific cost, force a Joint Trackage deal between Barstow & San Bernardino with the Santa Fe crowd, and build up a network of branches around the Los Angeles Area.

Coal, oil and water facilities on the Salt Lake Line all came to a ripe, rotten old age at the same time. The dust dry desert between San Bernardino and within a hundred miles of Salt Lake is short of water. Summer heat is terrific. Mountain grades make Diesel Regenerative electric braking a useful tool to speed downhill train operation.

But competitive demands for the rich Los Angeles trade has demanded a two-way Class A Railroad on par with the Pennsy or New York Central, in order to keep up with the competition given by the Santa Fe and Southern Pacific. Shall it be costly double tracking and expansion of steam power, or shall it be a highly modernized, electronically signalled, Dieselized railroad with about 80% of the capacity of a full double track line?

The answer was to be found in the same set of studies that led the Burlington into Diesel and CTC traffic control; the Kansas City Southern into longer and fewer trains hauled by "Big Diesel" and coal-less railroads like the Gulf Mobile & Ohio and Atlantic Coast Line into Diesel.

By the Spring of 1948, Union Pacific will have 600 miles of its Los Angeles-Salt Lake City line converted to Centralized Traffic Control some 800 cattle cars equipped with steel wheels, twin cushion draft gear, Timken roller bearings and streamliner yellow paint, plus a fleet of 6,000 hp. high-speed freight Diesels, to give a daily, or twice daily, 30 hour stock train move between Los Angeles and Salt Lake City. He will have a $14,600,000-650-mile program of new 133 lb. steel rail going through the whole System; terminal two-way radio on a fleet of yard Diesels and cabooses, in the System's busiest terminals in Denver, Omaha, Salt Lake City, Seattle, Los Angeles, Portland and Pocatello.

And by that time, nearly all of the 245 new Diesel locomotive units, a fleet of 1,000 hp. switchers, 1,500 hp. freight units and 2,000 hp. hp. passenger units will be in operation throughout the System to permit handling most of the fast Chicago-Coast passenger trains and all trains of every kind between Salt Lake and Los Angeles and the bulk of the Metropolitan Terminal switching areas re-equipped with snappy Diesel switchers. Who says America's far-flung railroad industry has reached the end of all its frontiers.

It is interesting to observe that every time a big U. S. System starts thinking of Diesel, it starts thinking of signalling, rails, switches, and speeding up service to compete with trucks and steamships, or vice versa. One calls for the other. There is no use of spending large sums on Centralized Traffic Control and keep on running steam trains that stop every 100 miles for fuel and water or every once in a while for hot main bearings. Conversely, there is little use in investing in modern Diesel locomotive power if track and signalling conditions limit the speed and loads to the pace of the old steam power.

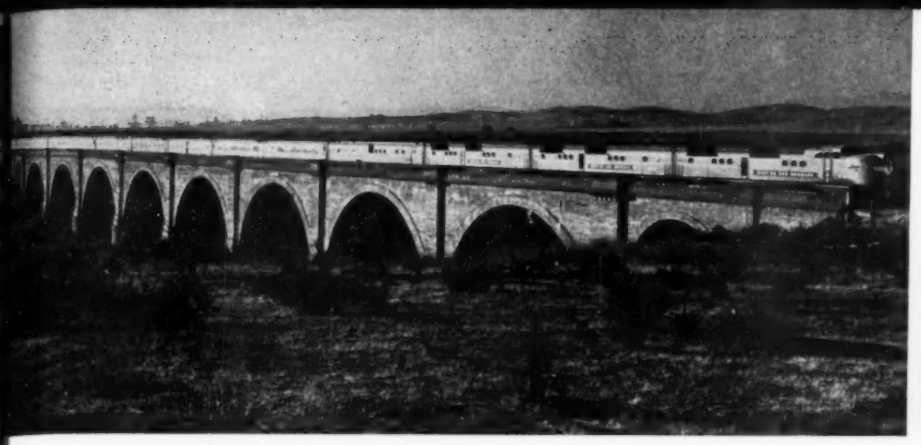
So the cheapest, most economical thing to do is to modernize the longest stretch of "Main Line" that forms an effective operating unit.

Union Pacific first gingerly tested out a General Motors Diesel locomotive in competition with its "Big Boy" 4-8-8-8-4 steam locomotive, biggest steamers ever built. This was at the start of the War. The results were so damaging to coal-fired steam of this size that the whole thing was hushed up and forgotten, until the price of coal and coal mine strikes began to plague and worry the management.

Early in 1946 the world's first Opposed Piston Diesel locomotive, by Fairbanks Morse, was taken out and tested on the main line between Green River and Ogden and the Los Angeles-Salt Lake all the way to the Movie Capital. Finally, in June of 1946 it was chosen to operate as a passenger locomotive, then the company got into high gear in its plans for abandoning steam on its Desert line to the Southland metropolitan area.

As traffic increases to the Los Angeles region, it becomes more complex and more difficult to handle, especially as heavy industry generates special traffic loads within themselves. The advent of the Kaiser steel operations at Fontana has given rise to a miniature Pittsburgh & Lake Erie ore-rock and coal move. Citrus fruits moving East along with vegetables and imported stuff from the tropics; the growing Westbound move of large quantities of dairy and beef cattle, increase in high-speed passenger, mail and express movements; heavy seasonal tourist travel and the mounting two-way move of manufactured goods, all add to the growing complexity of this section of the Union Pacific Railroad.

Three simple kinds of Diesel motive power units answer the problem. The 1,000 hp. Diesel switcher is practically the U.P. standard. The 1,500 hp. short-wheelbase freight Diesel unit, with the A & B type cabs and the 2,000 hp. passenger Diesel unit, with its reserve capacity of fuel oil and heating boiler water, is standard throughout the system. Advent of the 1,500 and 2,000 hp. Fairbanks-Morse Road-Switch-General Purpose single Unit Diesel complete with cab, gives a 4th type of Diesel for efficient use on light freight or switch runs; fast light branch work and ter-



Another view of EMD, 5400 hp. road Diesel hauling "City of Los Angeles." Each unit develops 1800 hp.

One of the new 6,000 hp., 4-unit EMD freight locomotives for Union Pacific. 72 of these 1500 hp. units have been ordered.

minal transfer service that is just too heavy for the 1,000 hp. switcher. The added tractive effort is needed for assembling of today's 5,000 ton freight trains—or taking them apart.

By the middle of July, 1947, according to official announcement by President Ashby, the U.P. had 112-1,500 hp. Diesel freight units—28 complete locomotives; 15-1,500 hp. passenger units and 16-2,000 hp. passenger units. In August 5 additional 1,500 hp. all-purpose units and 5-2,000 hp. road Diesels were added, and again, on Sept. 27, announcement was made of 5 more 2,000 hp. road units. These, plus 31 new switchers, comprise the Union--Pacific's 281,000 hp. of 1947 Diesel locomotive purchases. ALCO—EMD—FM all share the big order proportionately.

The U.P. program breaks down as follows:

FAIRBANKS MORSE:

15—2,000 hp. passenger road units.
5—2,000 heavy duty road units.
5—1,500 hp. all-purpose road-switchers; total 37,500 hp.

AMERICAN LOCOMOTIVE COMPANY:

40—1,500 hp. freight units.
6—2,000 hp. passenger units; total 72,000 hp.

E.M.D. DIVISION OF GENERAL MOTORS:

72—1,500 hp. freight units.
15—1,500 hp. passenger units; total 130,000 hp.

The switcher backlog order of 31 is mostly divided between American Locomotive and Electromotive Division of General Motors. Extensive service facilities are already prepared.

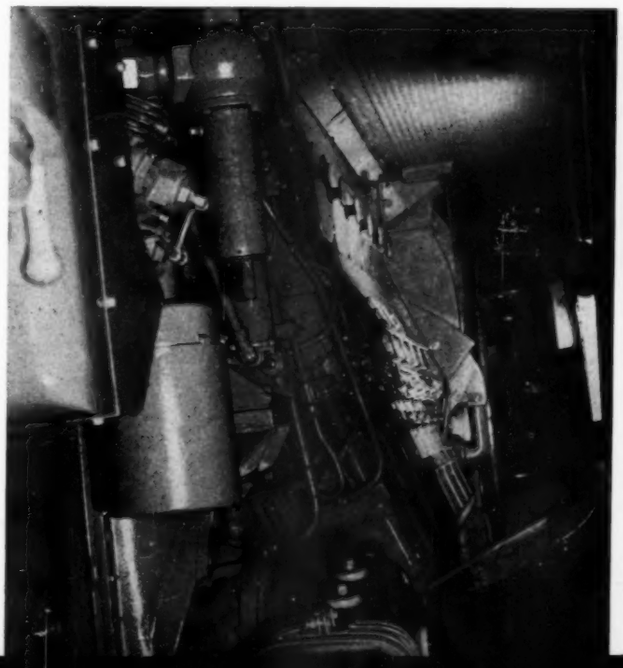
Utilization of Diesel power on Union Pacific trains will fit nicely into the all-Diesel program of the Santa Fe over Cajon Pass, between San Bernardino and Barstow, whose tracks are used jointly by the two roads.

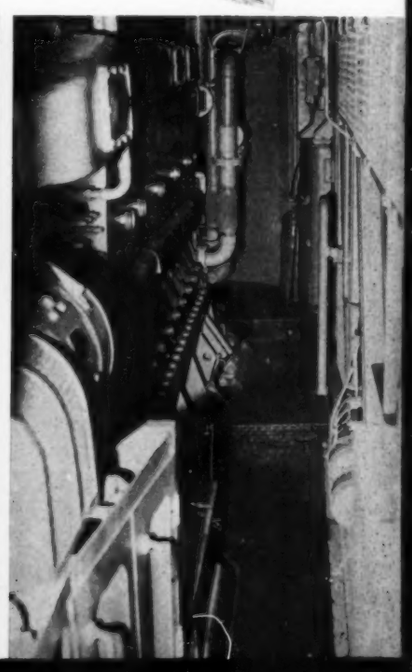
*As of Jan. 1, 1947, the U.P. had 17 road-passenger Diesels, some shared jointly with S. P. & Northwestern; no Diesel freight locomotives and 112 Diesel switchers.*

Celebrating arrival of first EMD freight Diesel last summer are W. T. Price, traffic manager; E. E. Baudendistle, assistant road supervisor of Diesels and Ben Johnson, Superintendent, Diesel maintenance, right.

(Below right) 2,000 hp, 10-cylinder Fairbanks-Morse O-P Diesel aboard Road Passenger Locomotive.

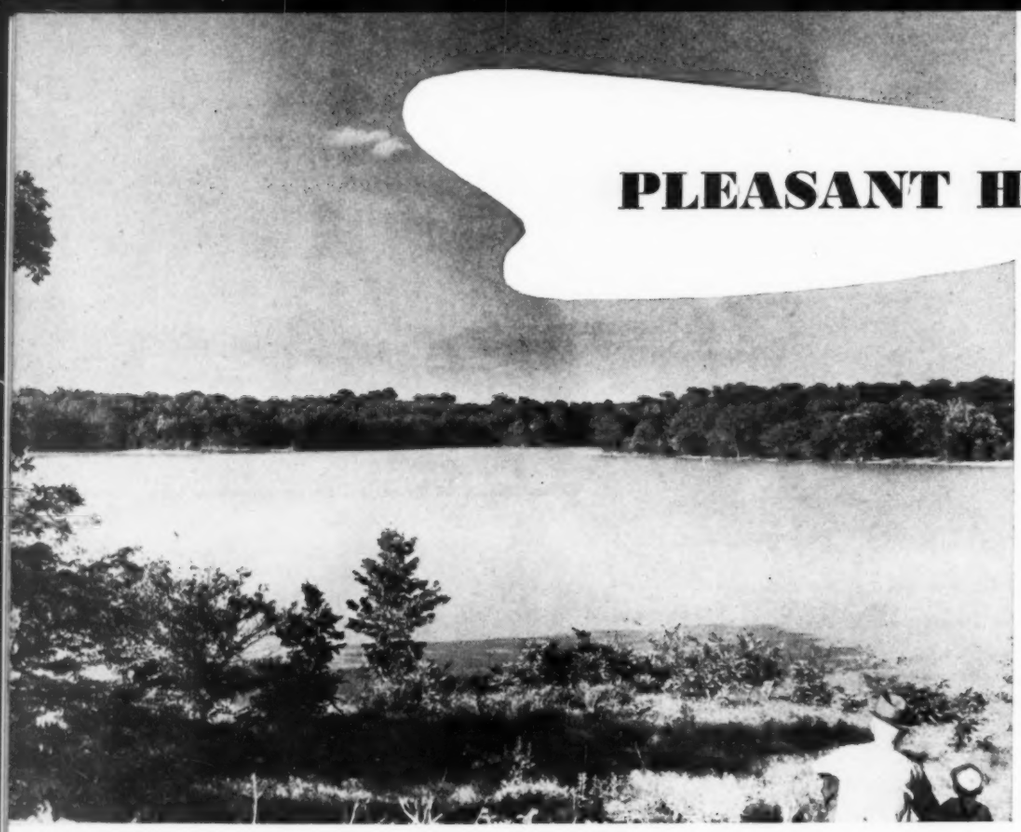
(Below) 16-cylinder, 2000 hp, supercharged Alco Diesel in passenger unit.





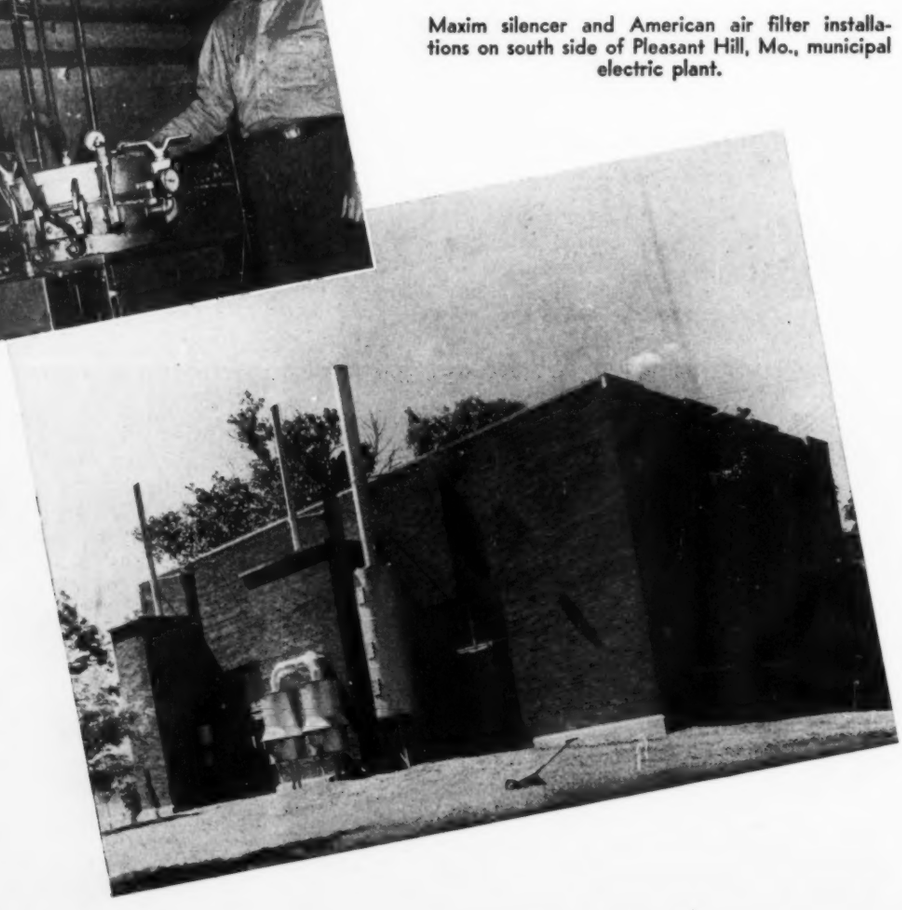
# PLEASANT HILL, MISSOURI

*By* A. V. REITER



View of new Pleasant Hill, Mo., city lake, which April rains filled within a few days after its completion. The 95-acre lake is situated on 238 acres of land bought by city with profits from municipal electric plant.

Superintendent Joe Baubion looks over the Hilco oil reclaimer installation in basement of Pleasant Hill, Mo., municipal electric plant.



Maxim silencer and American air filter installations on south side of Pleasant Hill, Mo., municipal electric plant.

THE earnings, expansion, and the civic improvements made possible by the eight year old municipal light plant of Pleasant Hill, Missouri, are impressive. The gross profit for the past twelve months from this municipally owned light and power plant was $24,943.00. During the first year of operating 1,456,200 kws. were generated. By the end of 1946 the kilowatts generated increased 42% over the first year's operation which necessitated the addition of a Fairbanks-Morse 690 hp. six cylinder 14 x 17, model 33-E-14 generating set. This new engine augments the original plant, which consisted of two 450 hp. Worthington Diesel engines. With the additional new Fairbanks-Morse engine the plant now has an installed capacity of 1073 kilowatts.

The earnings from the power plant have financed the preliminary steps toward the new city water supply project, and the record of the plant's profits has made possible the sale of bonds without any increase in the taxes levied on the community. The initial expenditures from the plant's earnings included the purchase of the remainder of the block north of the light plant as a site for the new filter plant which will be built this fall, and of the 231 acre lake site, as well as engineering and legal expenses involved. To further the project including the new filtration plant, an additional $115,000 was needed. In view of the earning power and good management of the municipal plant, these bonds, that would require no additional taxes to be levied, were in demand and sold at the low interest rate of 1 and 1/3c.

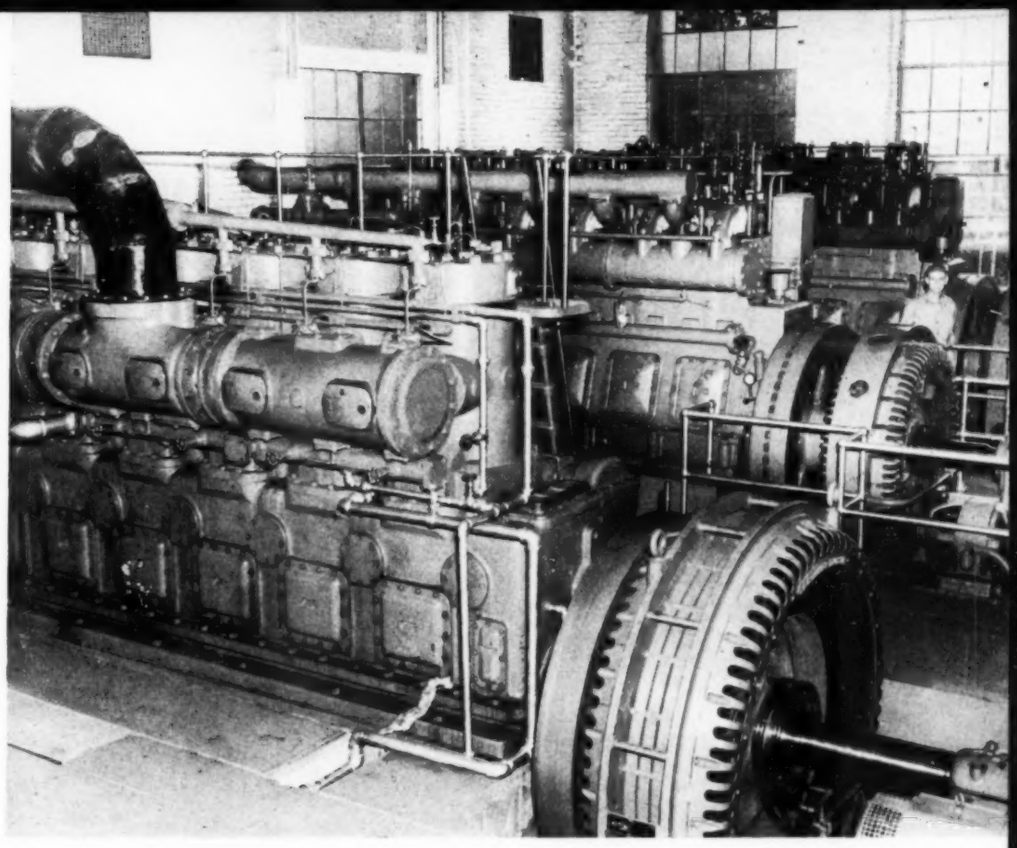
This spring the lake storing 275 million gallons of water was filled by the April rains and flowed over the spillway, and the largest municipally owned lake in Western Missouri was complete. The water will be diverted temporarily into Big Creek and down to the Missouri Pacific dam and a temporary pump station, until the three mile pipe line to town and the new filtration plant adjoining the municipal power plant are complete. Thus, as a result of its municipal

light and power plant, Pleasant Hill will have one of the finest water supplies in the section and may dispense with its obsolete and costly former system. Moreover, the gravity flow pipeline will deliver an adequate water supply to serve the community and any new industries.

The lake, over and above its utilitarian value, will provide a scenic site for public recreation and will prove a drawing power to the surrounding area. Pleasant Hill, a town of 2500, is thirty-five miles southeast of Kansas City. This June some 14,000 black bass fingerlings were put into the new city lake by the state conservation commission, and crappie, bluegill, and perch will be added this coming fall. The fact that the Pleasant Hill municipal plant was installed in a town which was the stronghold and once the main generating center of the Missouri Public Service is interesting in itself. As in such cases, this was not accomplished without a struggle. The Pleasant Hill *Times*, for instance, advocated the municipal plant for ten years before the issue ever came to a vote, at which election it carried the necssary two-thirds majority. A questionnaire was sent to thirty mayors of Missouri towns having municipal light plants asking whether according to their experience they would advise municipal ownership. The answer in every case was "Yes!" This and the reasons offered did much to influence public opinion.

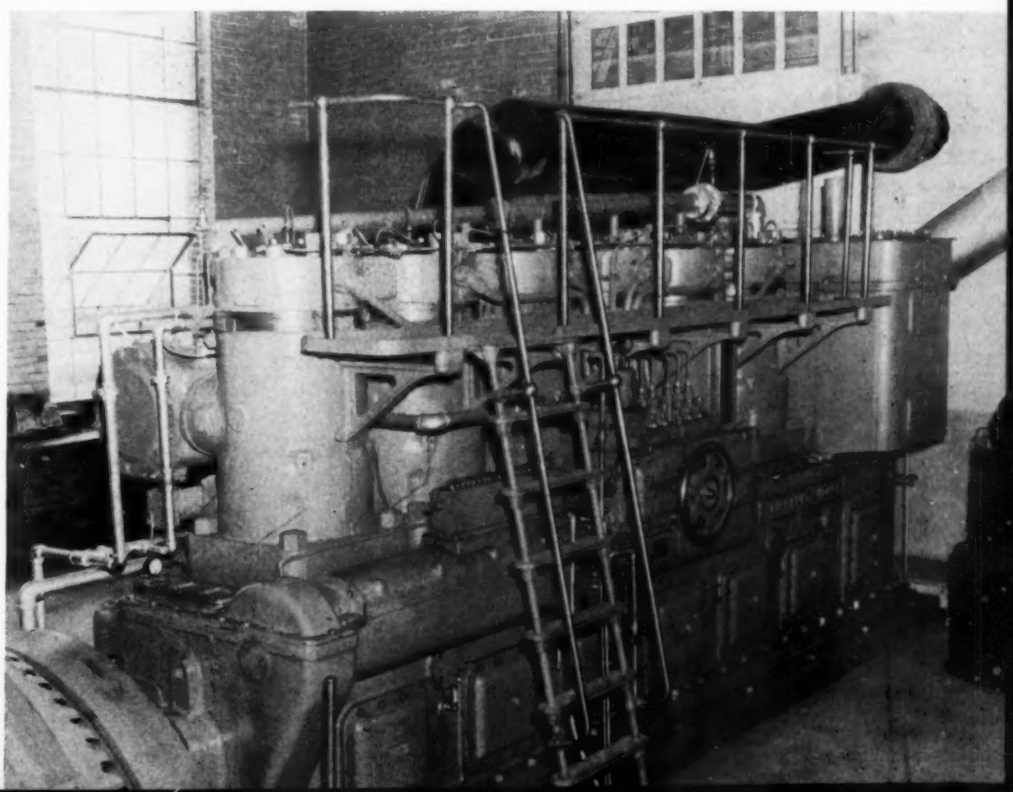
The plant now consists of the Fairbanks-Morse 690 hp. Model 33-E-14, 300 rpm. 14 x 17 Diesel generating set added recently to the original two 450 hp. Worthingtons at 327 rpm. 13¼ x 17½ that were installed with PWA aid. The three engines are equipped with Woodward governors, Maxim silencers, American Air filters, oil bath type, and Brown Instrument Company pyrometers. Auxiliary equipment consists of a hand-geared traveling crane by Chisholm-Moore, and Nugent and Klean filters. The lube oil reclaiming is handled by a Hilco as well as a Midwest Manufacturing Co. continuous type oil filter. Pleasant Hill uses two different types of lube oil—Sinclair MH and Standard Oil MH, and the cleaning equipment is so arranged that each lubrication oil system is independent of the other. The cooling system is closed type with the cooling tower supplied by the United Cooling Tower Company. At times the city has found it advantageous to clean the cooling system with Sand Banum. Marshalltown gauges are used in connection with a Viking alarm system for low pressures and excessive temperatures. The switchboard equipment is supplied by General Electric.

Pleasant Hill is situated in a diversified agricultural center but carries its peak load, contrary to most towns of its size, from 9 a.m. to noon due to the unusually heavy proportionate industrial load. The plant serves everything in the city including the American Scale Co.; the Arctic Dairy Co.; the Colonial Poultry Farms; the A. D. Mohr Greenhouses; J. R. Prewitt & Sons, manufacturers of the Belsaw saw; and the Levner Co., garment manufacturers. Pleasant Hill is now in the enviable position of having a power plant that has recently increased its capacity with a 690 hp. Fairbanks-Morse Diesel generating unit which will assure the city and its industries of economical and adequate power, along with reserve capacity as an attraction to new industries.



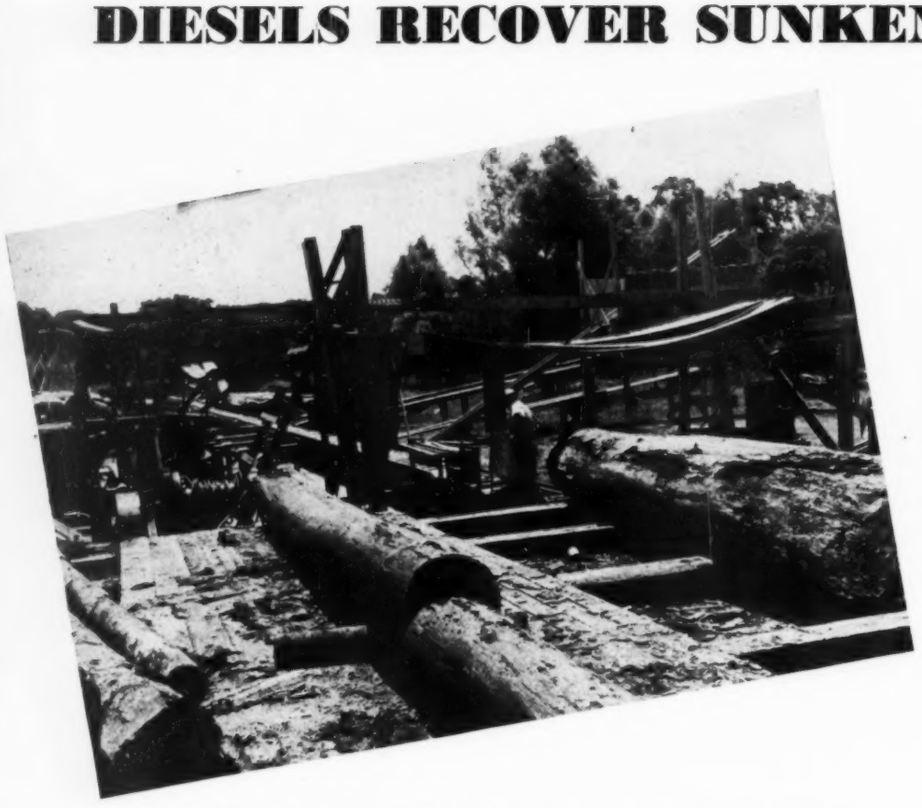
**Engine room at Pleasant Hill, Mo., municipal electric plant. One 690 H.P. Fairbanks-Morse unit installed late in 1946; two 450 H.P. Worthington units installed when plant was built in 1939. Total generating capacity, 1073 kilowatts.**

**Fairbanks, Morse & Co. 690 H.P. Model 33-E-14 Diesel generating unit. Control side.**



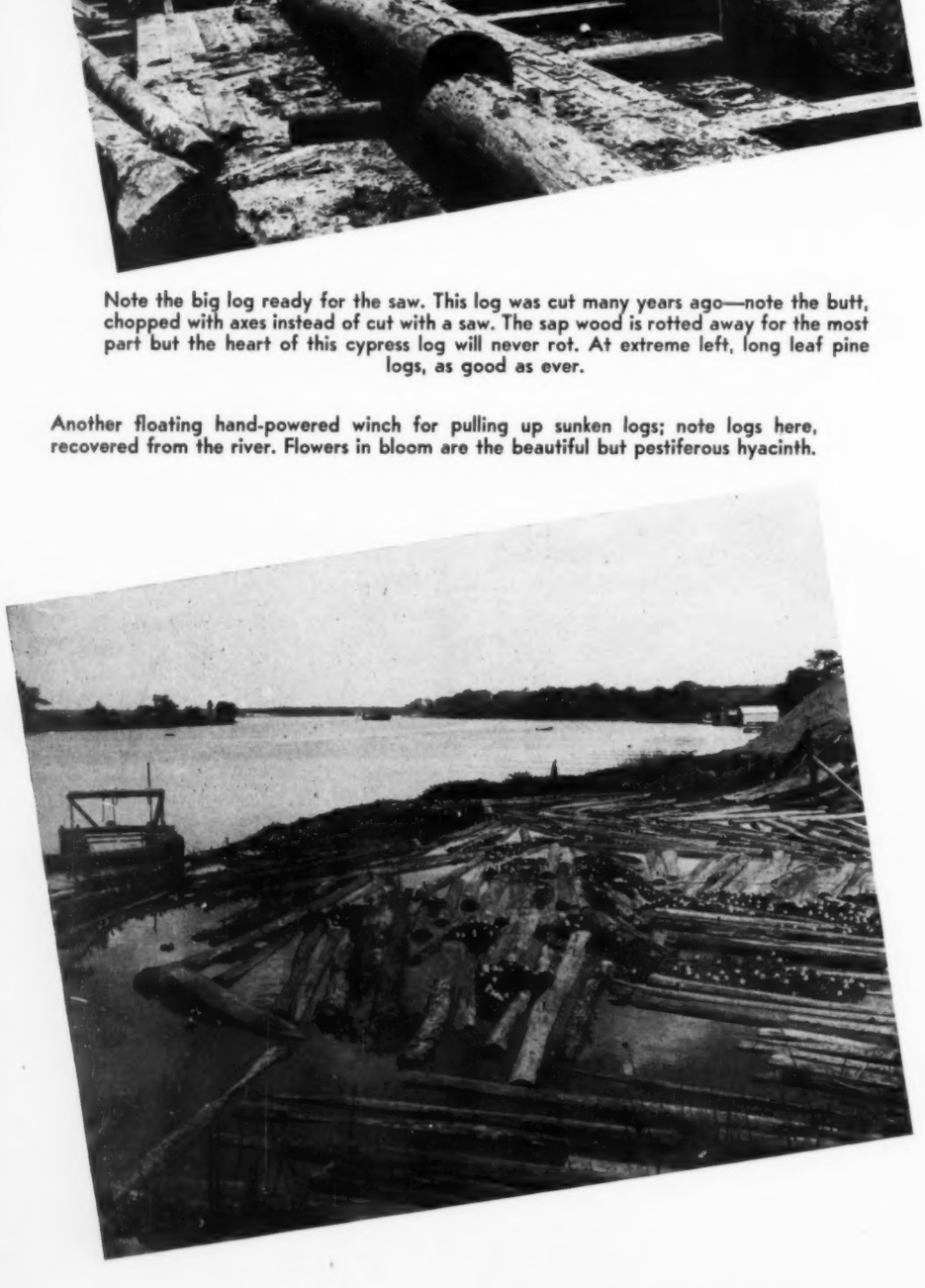
# DIESELS RECOVER SUNKEN TREASURE

*By* DOUGLAS SHEARING



Note the big log ready for the saw. This log was cut many years ago—note the butt, chopped with axes instead of cut with a saw. The sap wood is rotted away for the most part but the heart of this cypress log will never rot. At extreme left, long leaf pine logs, as good as ever.

Another floating hand-powered winch for pulling up sunken logs; note logs here, recovered from the river. Flowers in bloom are the beautiful but pestiferous hyacinth.



THERE is always something strangely intriguing about the thought of digging up buried wealth. Getting something for nothing is ever an attractive idea, and the proposition of profiting by something hidden or lost or abandoned generations ago by somebody else has urged many a man into the contrivance of queer devices. Every now and then some of these gadgets work, but dragging a Diesel engine into the set-up is highly unusual to say the least. Perhaps we should say right now that this particular Diesel does not act the traditional part of the treasure-seeker's forked hazel-wood branch and smell out the buried wealth; it merely transforms it into goods for the consumer and profit for its owner.

The scene is down near the mouth of Pearl River, in the southwestern corner of Mississippi near the Gulf. The Pearl is a big river, with plenty of lurid lore of the doings of pirate and robber gangs in its canebrakes and jungle fastnesses, and a man could probably stumble onto a few jewels and gold pieces should he dig in the right place. But Mississippi had other wealth than that buried by freebooters in the old days. Timber! The biggest part of south Mississippi was a huge forest of that wonderful long-leaf yellow pine, and on the tidal river banks, that equally valuable and never-rotting cypress.

Heaven alone knows how much timber was cut along Pearl River, and rafted downstream. Down near the mouth there were immense sawmills, waiting for the logs. And as every lumberman knows, not every log reaches the mill when a river is depended upon. Too many things happen. Rafts break up, become unmanageable; logs work loose, ride over each other; some are perhaps forced end over end: one end sticks in the mud, never coming loose, and as the log absorbs more and more water, it becomes heavier and eventually lies half-buried on the bottom of the stream. And at today's lumber prices to say nothing of the scarcity of good timber, that is buried wealth indeed!

Immersion doesn't harm heart yellow pine or cypress in the least. The thin outer layer of sap wood rots off, true; but that sap wood is

no good anyway; the heart remaining is as good as it ever was and probably twenty times more valuable.

One practical sawmill man who has taken full advantage of this sunken log situation is Charles A. Russ, who owns and operates a busy mill at Pearlington, Mississippi, on the banks of Pearl River near Highway 90, the famous through east-west route near the Gulf. Mr. Russ has been in the business for years; he gets much of his timber from scattered pickings still left in the forests, but at least fifty per cent of his volume, he says, comes from logs buried in Pearl River mud for maybe half a century. "And this grade of timber, yellow pine or cypress, all heart, long lengths and wide widths, simply cannot be duplicated today at any price," Mr. Russ declares.

And the ideal way to power a small sawmill operation, according to this operator, is by Diesel—one big enough to do the job but not so big as to involve a high overhead and maintenance cost.

Driving Mr. Russ' plant is a Buda Diesel, model 6 DC-844. This is a four-cycle, six-cylinder job able to put out around 150 hp. at 1400 for constant industrial operation; this one is turned at 1200 rpm. for normal operation, all day long, five days a week. At this engine speed, the mill produces lumber as fast as the available labor can handle the output, taking it away from the plant and stacking or shipping it.

This is no special installation but a stock engine, sold and installed by the Gulf Engine & Equipment Co., Buda distributors in New Orleans. Starting is electric, using a Delco Remy starting and generating system, with Firestone batteries. Cooling is by radiator. Fuel oil filtering is by Purolator primary and secondary filters. Lube oil is protected by a "Commercial" 3-cartridge lube oil filter. Fuel injection is American-Bosch. A Twin-Disc power take-off is belted to the plant's shafting.

This engine pulls considerable machinery, including the main circular saw, a #2 Corinth of 56 inch diameter with 54 teeth. The saw is turned at 600 rpm. Also, there is a 3-saw heavy duty edger, and a thirty-inch trim saw. The Diesel also pulls the slab conveyor, the skidder for dragging the logs up out of the river, and the 200-foot dust chain which moves the sawdust away from the plant and into the elevated hopper where it is loaded into dump trucks for final removal from the premises.

**Charles A. Russ, sawmill operator of Pearlington, Mississippi, and the Buda Diesel powering his mill. "First time I've had this hood off since last Christmas," says Mr. Russ, maybe stretching the point just a little but nevertheless pleased with his machine.**

Plant capacity is around 15,000 board feet in eight hours. In fact, says Mr. Russ, this is the usual output, depending somewhat on the efficiency of today's labor which just "ain't what it used to be."

This Buda was installed about twenty months ago and has been in constant operation ever since. No major overhauls or heavy repairs of any kind have been made and it starts as easily as it ever did. Lube oil economy is a definite feature. "We never add a drop," says this operator. "We change the oil every Saturday morning; after a week's running, the oil lever is generally down less than a quart, but we never put in any oil between the regular changes. We think this is economical operation; as for fuel, the engine burns around 25 gallons a day, which is pretty cheap fuel expense for 15,000 feet of lumber!"

Mr. Russ has another sawmill at Kiln, Mississippi. That plant is powered with an industrial engine burning tractor fuel; the rig is supposed to develop around 60 hp., says Mr. Russ, but the Buda Diesel at the Pearlington plant when operating under full load doesn't use as much fuel as the 60 hp. tractor engine producing less than half the power.

"How did you happen to make up your mind to buy a Buda?" we asked Mr. Russ.

"Might say it was because the Buda salesmen kept on my neck till I had to do something to get rid of them," suggests Mr. Russ, "but there's a little more to it than that, I reckon. We see a good deal of Budas around here. The drawbridge on the highway down there is turned by a Buda; it's a big heavy draw and the Buda has been operating it for years and they never seem to have any trouble. Then we see a number of Buda-powered towboats on the river, shoving big barges loaded with pulp logs; they don't seem to break down. Up above here I know of a derrick that does a lot of work, using a Buda. And then there's some gravel pits using Budas to pump with and that's really a heavy job.

"Yes," says Mr. Russ, "those salesmen were mighty persistent, but they didn't really sell me this Buda; I bought it; I wanted it anyway.

"And up at my other plant at Kiln, you can quote me as saying there's going to be another Buda running that sawmill. So you can make up your own mind whether or not I'm what you'd call a satisfied customer."

# DIESEL ENGINE DEVELOPMENT IN GERMANY
# PART III

## *Torsional Vibration Dampers*

*By* KALMAN J. DEJUHASZ*

IN the operation of present day high speed multi-cylinder Diesel engines, torsional vibrations represent a serious limiting factor. Therefore, their elimination or mitigation by dampers assumes high importance. Special urgency was attached to this problem in Germany in view of their wide use of Diesel engines in submarines and other warships with their requirement of safe and smooth operation within a wide speed range. Therefore, in investigating wartime Diesel engineering developments in Grrmany, special attention was given to novel ideas, trends and designs in torsional vibration dampers. Such developments may not be generally known in this country, therefore their description and illustration may be of interest to the American Diesel engine industry.

Before describing the individual designs, a brief digression into the phenomena pertaining to torsional vibrations may be of interest. This subject has been treated by elaborate and detailed theories and treatises (see Bibliography); the basic facts, however, are simple.

1. The crankshaft has torsional elasticity, and to it are attached rigid masses. Together they form a system capable of vibrating when excited by a periodic torque. In view of the fact that the crankshaft of a multi-cylinder engine is composed of several elastic elements and it is loaded with several masses, there are a number of natural frequencies — $f_1$, $f_2$, $f_3$ . . . *etc.*, at which such a crankshaft is capable of vibrating. These natural frequencies can be calculated from the design data of the engine and determined experimentally after the engine has been constructed.

2. The engine power is supplied by a periodically fluctuating torque (composed of the pressure torque and of the inertia torque); the power is absorbed usually by an approximately even torque (propeller, generator). As a result, during certain portions of the engine cycle there is an excess of power and the excess work is stored in the form of elastic energy of the shaft (increased torque), and in the form of increased kinetic energy of the rotating parts; at other portions of the engine cycle there is a deficiency of power compared with the load and the work demand is supplied by the release of elastic energy from the shaft and by the decrease of kinetic energy.

Thus the shaft-mass system is subjected to periodic torque impulses, the basic frequency of which, in the case of a two cycle 1-cylinder engine running at n rpm. is: $F_I = \frac{i\,n}{60}$

and in the case of a four cycle engine $F_I = \frac{i\,n}{120}$

where: F = frequency, cycles/sec.
i = number of cylinders
n = engine speed, rpm.

The torque impulses are not simple harmonics, but they can be resolved into several (or an infinite number) harmonics, i.e. overtones of the 2nd, 3rd, etc. order, the frequencies of which are integer multiples of the basic frequency, .e., $F_{II} = 2F_I$, $F_{III} = 3F_I$, . . . etc. In Diesel engines the usual condition is that the amplitudes of the harmonics are decreasing with increasing order of frequency, therefore usually only the first four or six orders have to be considered.

3. As long as the frequency of power impulses does not coincide with a natural frequency of the shaft, i.e., F not equaled to f, the power developed during each revolution is absorbed by the load and no accumulation of elastic energy in the shaft and of kinetic energy in the rotating masses will take place. In the particular case, however, when the frequency of power impulses is equal to one of the natural frequencies of the shaft-mass system, which condition is called "resonance," then the elastic and kinetic energies stored in the shaft-mass system, by successive power impulses, accumulate, and in the absence of damping would produce an ever increasing vibration amplitude, until the strength of the shaft is exceeded and the shaft breaks. Actually, damping is always present, therefore the vibration amplitude would not reach infinite values; nevertheless, the actual value may be sufficient to produce a fracture of the shaft.

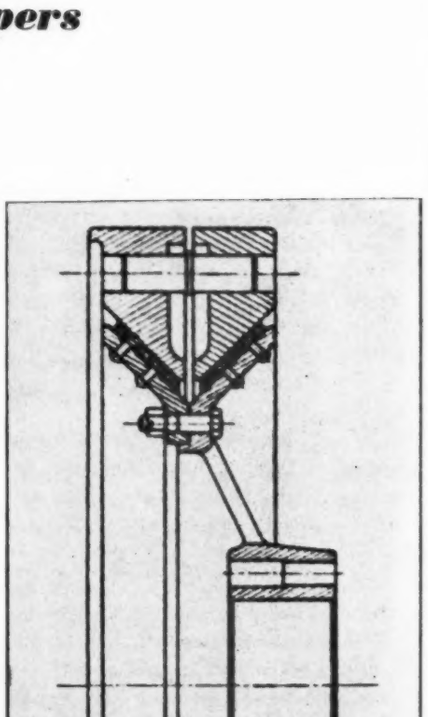


Figure 1. Friction-type Vibration Damper.

The engine speeds at which resonance occurs (i.e., F = f) are called "critical speeds" and have to be avoided in engine operation, in the sense that such speeds should not be employed in steady operation.

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4. In an engine with four or fewer cylinders, (i.e., few power impulses per revolution) the shaft is usually short and rigid and its natural frequency is likely to be well above the significant orders of power impulse frequency.

In multicylinder engines the shaft is long and has numerous natural frequencies in a wide range. Owing to the multiplicity of cylinders the basic frequency of power impulses is high. Therefore, the inclusion of one or more critical speeds in the operating speed range cannot be avoided.

In multicylinder engines the shaft is long and has numerous natural frequencies in a wide range. Owing to the multiplicity of cylinders the basic frequency of power impulses is high. Therefore, the inclusion of one or more critical speeds in the operating speed range cannot be avoided.

5. In order to obviate excessive torsional vibrational amplitudes and stresses, vibration dampers are incorporated in engines. An essential element of a vibration damper is the inertia mass, usually in the form of a wheel, which is connected to the crankshaft by means of a frictional or elastic force or both. In operation, whenever a certain angular acceleration is exceeded a relative motion between the crankshaft and the inertia mass will take place, which motion is utilized for damping; thereby energy is absorbed and excessive vibration amplitude is prevented. It follows that torsional vibration dampers have to be mounted on the shaft at a location which has a large vibration amplitude, usually at the end of the shaft.

The torsional vibration dampers developed in Germany were several.

1. A simple and inexpensive type of damper, intended for engines of 300 or 400 horsepower, is the friction damper shown in Fig. 1. In this the inner rim of the wheel keyed to the engine shaft is covered with friction lining material on which the outer heavy rim rides. The outer rim is composed of two ring elements which are forced apart by springs distributed near the periphery, the compression of which is adjustable to produce the desired frictional force. During operation, whenever the angular acceleration exceeds a certain valve, slippage will take place between the inner rim and outer rim, whereby energy is absorbed and the vibration in damped. The advantage of this design is its simplicity; disadvantages are, that the action depends on the state of lubrication of the sliding surfaces, and that considerable wear occurs when operated near the resonant speed for an extended time. To mitigate wear, the damper has to be made of comparatively large dimensions.

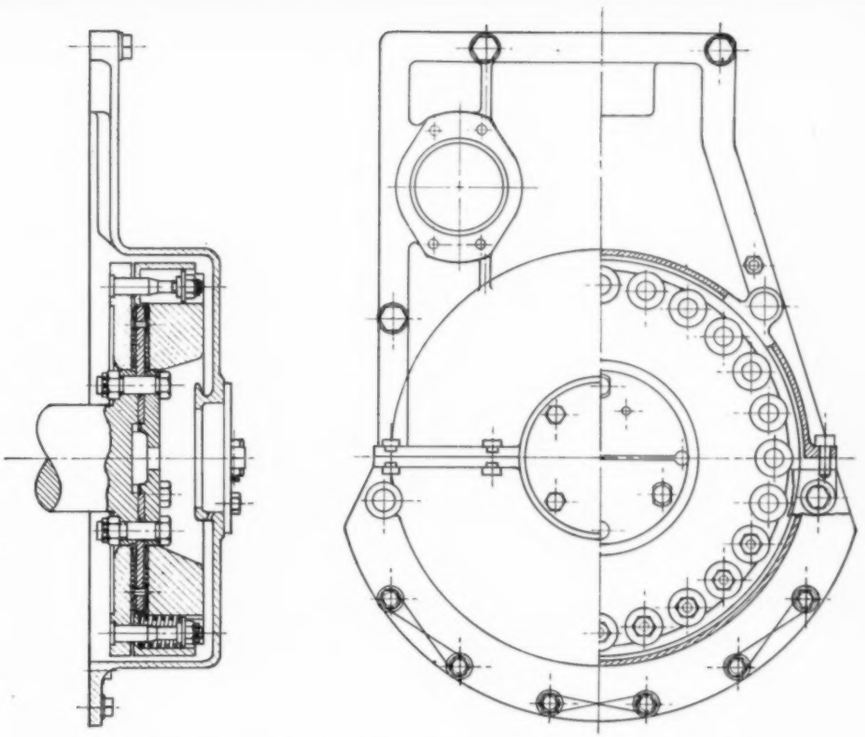


Figure 2a and 2b. Friction-type Vibration Damper, MAN, for engines of 7" x 9" bore and stroke.

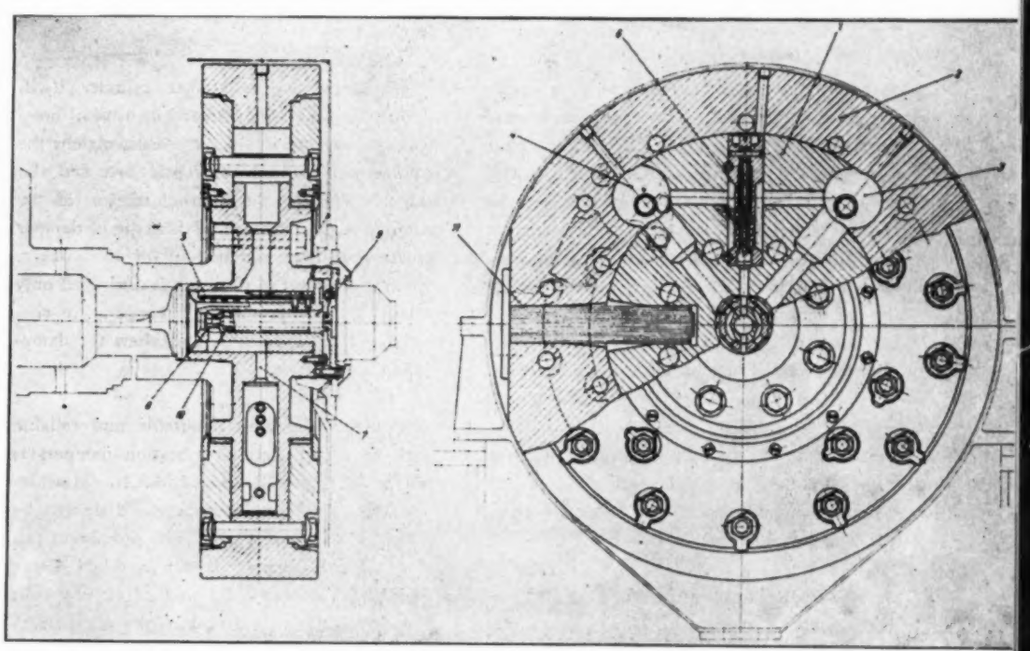
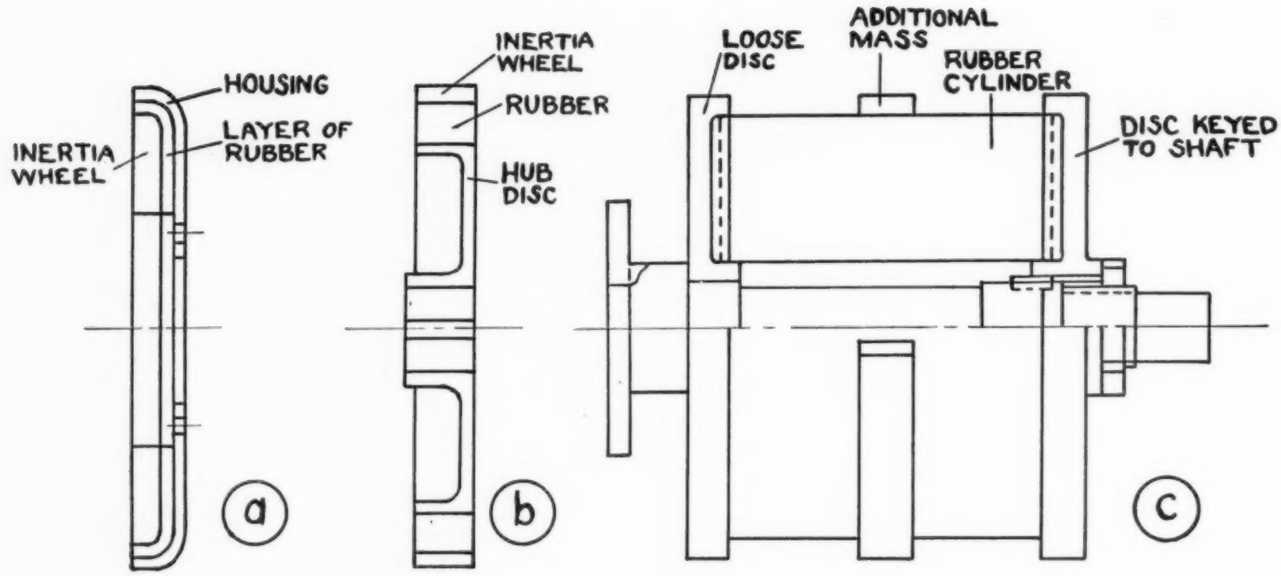


Figure 3. Hydraulic Vibration Damper by Sandner.

1—Inner hub rigidly connected to engine shaft. 2—Inertia wheel. 3 and 4—chambers for oil. 5 and 6—Flap valves of spring blades. 7—passage way for oil. 8—Spring loaded valve. 9—Valve spring. 10—Washer for adjusting valve spring compression. 11—Pack of leaf springs connecting hub portion 1 and inertia wheel 2.

A more elaborate frictional damper, used on some MAN-engines, is shown in Figs. 2a and 2b, the construction of which is evident from the illustration at the top of this page.

2. In the Sander damper shown in Fig. 3, the inner hub 1, which is connected to the engine shaft, is coupled to the outer wheel 2 by means of an elastic force exerted by the leaf spring pack 11, and by a hydraulic force exerted by the oil contained in chambers 3 and 4. Direct




**Vibration Dampers with Rubber Connecting Element. (a) Connection by Rubber Disc. (b) Connection by Rubber Ring. (c) Design by Foeppl; the rubber cylinder serves as the main inertia mass; one end of it is connected to a disc rigidly mounted to the engine shaft, the other end is connected to a disc rotatably mounted on the engine shaft.**

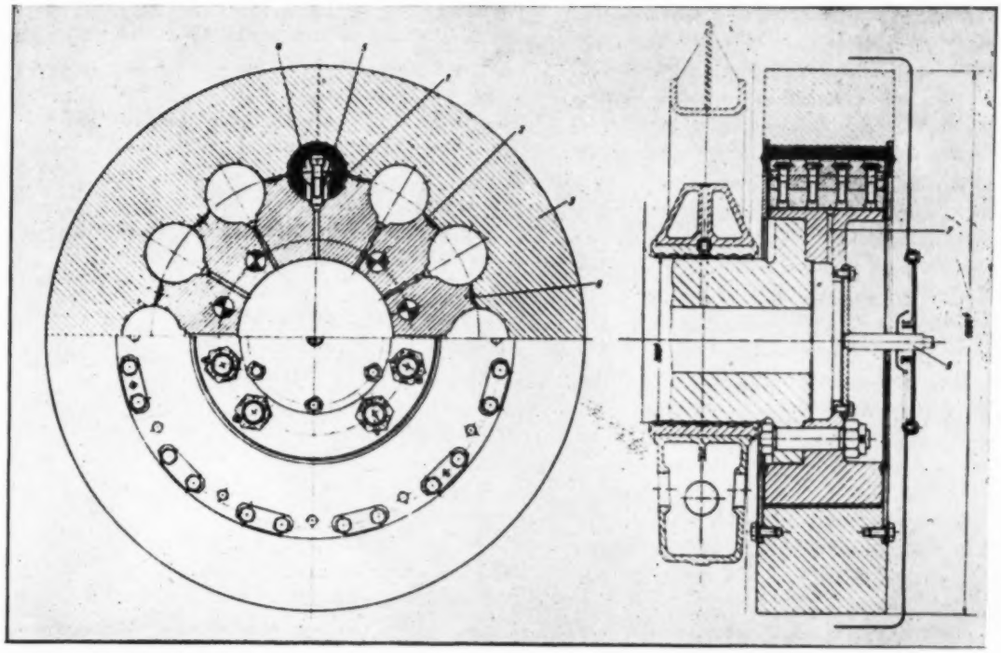
communication between the two chambers is prevented by the leaf spring valves 6 and it is permitted only through the centrally mounted spring loaded poppet valve 8; the spring 9 can be preloaded to a greater or lesser extent by means of using a thicker or thinner washer 10. The direction of flow is evident from the drawing. The greater the preload on the spring, the greater is the angular acceleration at which the damper begins to function. Thus in this vibration damper an elastic force is provided by the leaf spring pack 11 and also by the elastic compressibility of the oil; and a damping effect is produced by the pressure drop of the oil flowing through the spring loaded poppet valve 8, and also by the friction between the leaves of the spring pack 11.

3. The simplest form of elastically coupled mass is the rubber damper in which the inertia mass is connected to the hub portion (which is keyed to the shaft) by means of a rubber element. Three arrangements of such a vibration damper are shown in Fig. 4; in the construction shown in Fig. 4a, the inertia mass is of disc shape and is attached to the hub element by a thick rubber disc; in Fig. 4b, the inertia element is of hoop shape which is connected to the hub element by a rubber ring under radial compression; in Fig. 4c, another construction is shown, designed by Foeppl, in which a thick rubber cylinder is face-attached to the disc keyed to the shaft; most of the mass is contained in the rubber cylinder itself, though the mass is augmented by a metal hoop mounted around it. In these constructions the rubber provides both the elastic force and also the damping, by the internal friction of the rubber. A disadvantage of this type of damper is the low heat conductivity of the rubber, whereby the heat of damping is dissipated only slowly, thereby producing a temperature rise, which softens the rubber and alters the damping characteristics.

4. Probably the most adaptable and reliable type of recent German vibration dampers is the Sleeve-Spring damper of M.A.N. (Maschinenfabrik Augsburg-Nuernberg), designed by Pielstick, shown in Fig. 5. The prominent feature of this damper is the so-called sleeve spring, 1, composed of a pack of circular split springs tightly nested within one another. A number of such sleeve springs constitute the elastic connection between the inner hub portion 2 and the outer flywheel 3. In operation the outer flywheel 3 rotates on the bronze inserts 6 of the inner hub 2, and thereby compresses the two end portions of the sleeve spring. The outer leaves are of greater, and the inner leaves are of smaller thickness, in order to keep the stress in the several leaves approximately uniform. As the spring is compressed more and more, the leaves lie against the inner cylindrical block 4, and their spring rate increases as shown in the force-deflection diagram Fig. 5. To the cylindrical block 4, a stem 5 is attached, which engages with notches in the hub portion, and prevents the rotation of the spring pack and the dislocation of its several leaves. The entire inner space in which the sleeve springs are housed is filled with oil through the hollow shaft and the radial bores 7. The damping effect is produced by the friction of the spring leaves on one another, as shown by the hysteresis loop of chart, Fig. 6. In addition some further damping is produced by the dislocation and squeezing of the oil within the spring housing as the gaps between the spring and housing are increased and decreased.

The advantage claimed for this sleeve ring construction is its wide adaptability. The springs themselves are made only in a few standardized sizes. For a given damper design the number of springs can be chosen in accordance with the torque to be transmitted, either by varying the number of packs in each housing bore, or by varying the number positioned circumferentially. In Fig. 5 the number of springs is $12 \times 4 = 48$; if it is desirable to use a lesser spring force, then one or several pairs of springs can be removed from opposite housing bores. For fine adjustment the diameter of the cylindrical blocks 4 can be varied. Finally, the sleeve springs can be interchanged with others having a greater or smaller leaf thickness. The described construction can be

Figure 5. Sleeve spring Vibration Damper by Pielstick (M.A.N.) 1—Sleeve Spring. 2—Hub portion rigidly connected to engine shaft. 3—Inertia wheel. 4—Cylindrical block to limit deflection of sleeve spring. 5—Stem attached to block 4 to prevent rotation of sleeve spring. 6—Bronze insert. 7—Oil passage to sleeve spring housing.



adapted to serve also as an elastic vibration damping coupling between the engine and the driven machine (or propeller, or electric generator). An evident advantage of this construction is that the mounting dimensions of the gear are not increased because the sleeve spring can be housed within the width of the gear.

A typical case of the improvement in performance is shown in Fig. 7 which represents the amplitudes of torsional vibration of an installation, at various speeds, without and with a sleeve spring damper.

In such installations in which extreme freedom from torsional vibration is desired, the performance can be improved by the use of both, a vibration damper at the free end of the shaft, and an elastic coupling between the engine shaft and the driven machine.

Some recent German literature dealing with this field is given in the Bibliography which appears on page 86 of this issue.

Figure 6. Characteristics of Sleeve Spring, Load vs Displacement.

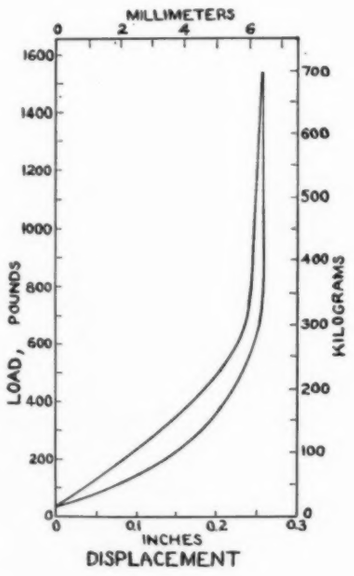
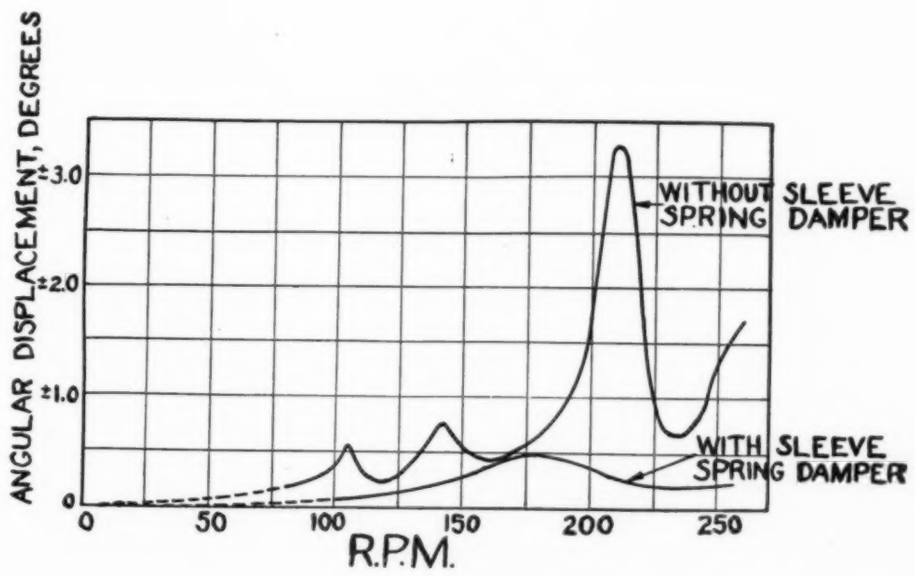



Figure 7. Vibration Amplitudes of an Installation without and with Sleeve Spring Damper.



CENTURIES of fishing by natives have depleted the seas adjacent to Puerto Rico and today the problem of finding suitable fishing grounds has become one of long-range cruising. To engage in exploratory fishing in hope of finding suitable grounds for food fisheries, the Puerto Rico Agricultural Company this summer acquired a new 70-foot all-welded steel vessel which will scour the waters off the coast of Venezuela, searching the 400-mile mud bank stretching from Trinidad to British Guiana for suitable food fish.

The mission of this ship, the *Reina Del Caribe* (Queen of the Caribbean), necessitates a long cruising range and facilities for keeping the catch until its home port, San Juan Puerto Rico, is reached. To attain the maximum cruising range for this size ship, a Cooper-Bessemer Diesel engine was installed. This engine gives the vessel a cruising radius of 6,000 miles with a fuel capacity of 6,000 gallons. Speed of the ship will be 10 and one-half knots. Fuel consumption will amount to .4 lb./bhp./hour.

The engine, a direct drive with built-in sailing clutch, will develop 250 horsepower at 600 rpm. Four cycle, it has a nine-inch bore and 10 and one-half inch stroke. It is fresh water cooled and the pistons are air cooled, with the engine pressure lubricated. A feature of this model is the one-piece cylinder and cylinder head, which makes for added cooling capacity. The engine is built of cast meehanite metal throughout.

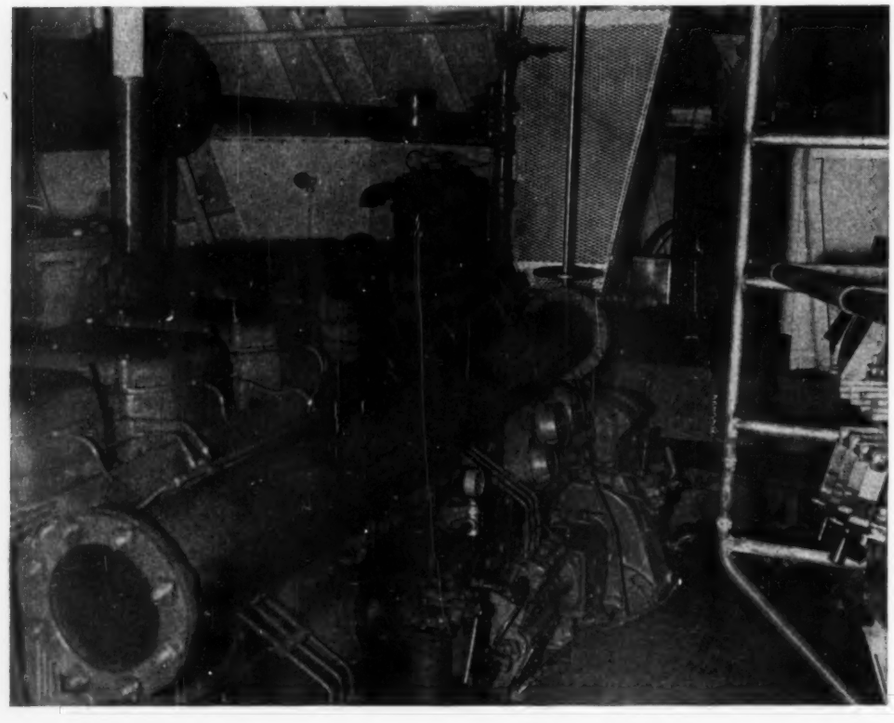
The *Reina Del Caribe* was built by the Long Marine Construction Co. at Seattle, Wash., and is the first of its type to be built in the Puget Sound country, just as this is the initial time a Cooper-Bessemer engine has been installed in such a ship. Cost of the vessel approximates $145,000. It is essentially a west coast seiner in style of construction, but in addition to seining it is equipped for virtually any type of fishing, such as Atlantic coast dragging, sharking, shrimping, and dragging and handlining chum tuna. Since its fishing work will be of an exploratory nature, the ship's equipment must meet any contingency of the food fisheries.

Key to success of this venture in finding new food fish for Puerto Ricans will be the ability of the ship to stay at sea, to cruise long distances, and to return the capacity load of 75 tons of frozen fish to port. And that is where the Diesel engine comes into service, and along with durability and reliability must go economy of operation if the exploring for fish is to succeed. Primarily engaged in the raising and refining of sugar and the canning of pineapple, the Puerto Rico Agricultural Co. is entering this new field as an experiment, with its assets of $12,500,000 aiding in development of its fishing division.

The engine is direct reversible, with the reverse mechanism, which is air operated, on a sliding camshaft. The clutch, too, is air operated, and the engine is air starting. Other features of the power plant include Woodward oil relay type hydraulic governors, Ross oil cooler and Ross heat exchanger, built-in Timken roller thrust bearing, Alnor pyrometer thermo-couples, and the Cooper-Bessemer pressure fuel injection system. Salt and fresh water pumps are built in and an air compressor is driven off the forward end of the engine. Crank shaft, crank pin journals and main bearing are seven and one-quarter inches in diameter. Weight of the engine is 18,000 pounds. Auxiliary power for the ship's lighting system and electrical equipment is supplied by two 20 kw., 110 v. D.C. generators, each turned by a General Motors 2-271 Diesel.

With the ship powered to stay away from its home port on exploration fishing, the next problem was to provide adequate refrigeration for the cargo. This was accomplished by installing a quick freeze room of 480 cubic feet capacity where, at −20°F., the fish will be frozen and then transferred to a hold for storage. The hold, of 4000 cubic feet capacity, will be held at zero Farenheit. With sharp room and hold filled to capacity, the vessel will carry 75 tons of fully refrigerated fish.

Quarters for the crew of 10 men aboard the ship are a far cry from the typical fishing vessel. There are several small staterooms, instead of a forecastle. Each is trimmed in mahogany and has forced ventilation. The entire superstructure of the boat is insulated.

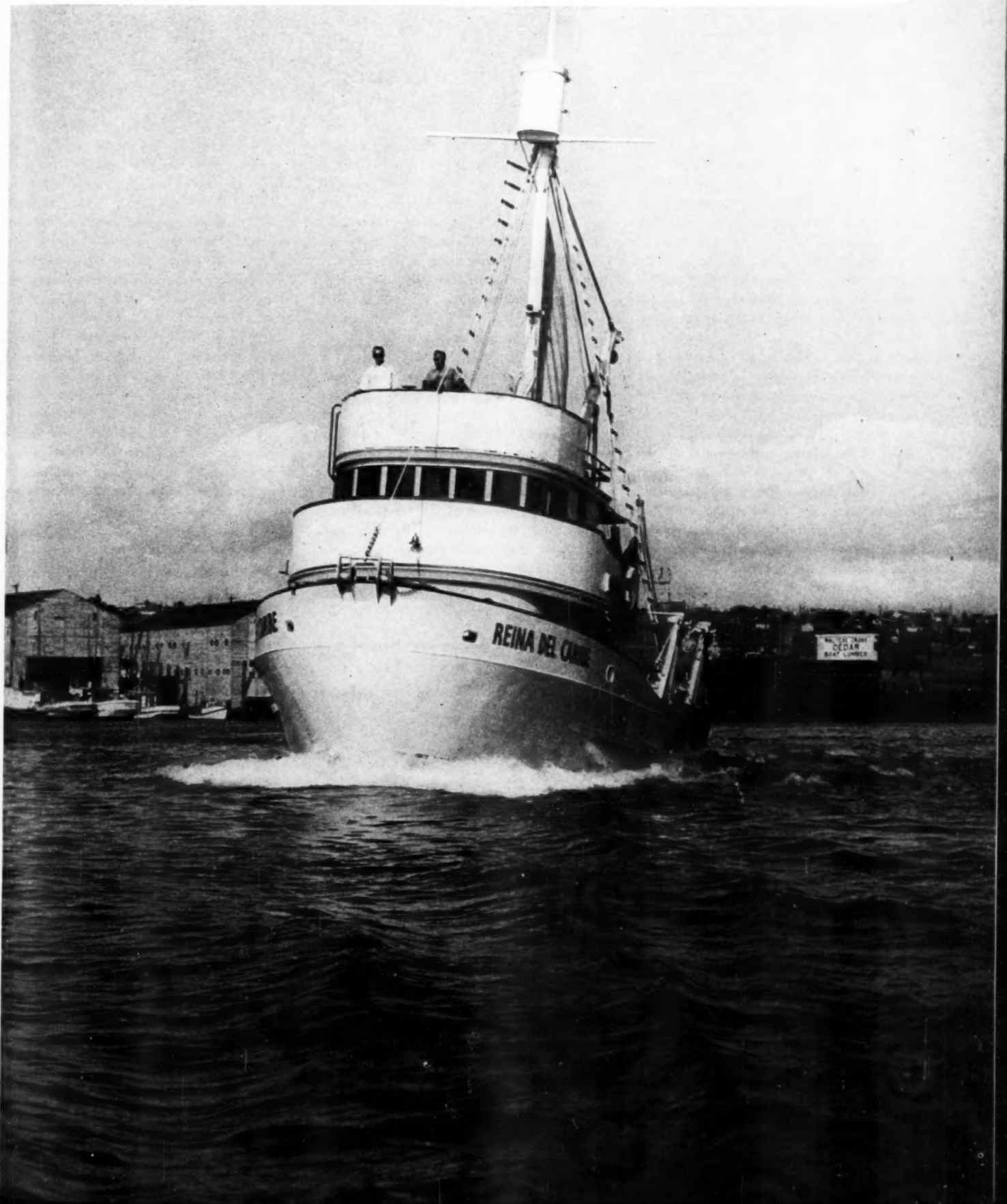


(Left) 250 hp, 600 rpm. Cooper-Bessemer Diesel powers the "Reina Del Caribe". Engine is direct drive, has built-in sailing clutch, and is direct reversible.

(Right) Steel seiner "Reina Del Caribe" will operate in Caribbean Sea searching new fishing grounds. Her Diesel will drive her at 10½ knots.

# DIESEL SEINER FOR PUERTO RICO

*By* W. J. GRANBERG



# DIESELS AT THE WINDMILL PRESS

*By* J. H. M. SYKES

THE visitor to Messrs. Heinemann's Windmill Press, at Tadworth, in Surrey, is at once impressed by the striking beauty of the building and its tree-girt daffodil-strewn lawns, with goldfish pools and gravelled paths suggesting that the red-brick Georgian building might be a county residence or a school, rather than a busy publishing concern which employs 250 people and from whence issue 6,000 books a day, as well as a number of weekly magazines.

Built in 1928, to the designs of Lord Gerald Wellesley, now the Duke of Wellington, the Press is situated in secluded country some four miles from the village of Tadworth, and in most respects it is self contained. The motive power for the printing machinery and the heat for the glue and metal pots is obtained entirely from electricity, generated on the premises. In view of the cultured dignity of the general design, it is especially interesting to note that Diesel engines were chosen as the power source. The proprietors had to consider not only reliability, but noise, vibration, and objectionable smell. A modern Diesel generating installation was found to fulfill their requirements in all these different directions.

The building is in the form of a square U, with a height of two stories. The left hand wing contains the printing presses, the centre portion the power house, and the bindery and composing rooms are on the right. Large steel windows with rounded tops give an impression of lightness and airiness. In the two main departments of the Press there are about 75 electric motors, ranging from ¼ hp. to 15 hp. The system adopted is 230 volts D.C., permitting ease of speed regulation.

The first process in producing a book is to set the type. In the composing room Messrs. Heinemann use both monotype and linotype machines. The linotype employs brass matrices to cast a complete line of characters in a solid block of type metal, while the monotype keyboard operator causes holes to be punched in a roll of paper. These rolls are taken to a separate casting machine, which casts single letters using pneumatic means of operation. Both the linotype and the monotype need small electric motors and electric heat for the metal casting.

When the type is made up into forms, printing is either done directly from the type itself, or, in certain cases, from "stereos," or type-metal facsimilies made from the completed form. The completed type matter is then taken to the presses. For magazine work the Windmill Press employs a rotary machine, while for the majority of its work—that concerned with the high-quality novels, plays, and text books which they publish—flat bed Miehle machines are used. Book paper is printed with 16, 32, or 64 pages on a single sheet, and these large sheets of paper in stacks are then taken to the bindery. They are first folded on one of three special machines, which are extremely fascinating to watch. The sheets are folded and cut at a very rapid rate, and the output of the machine consists of "signatures," or small bundles of folded printed pages, of which some 16 or 20 form the complete matter between the covers of a book.

In order to ensure that the collators pick up every one of the signatures in the correct order, each one has a small black dot printed on what will be the back fold. When the correct number are assembled together in the correct order, these black dots can be seen progressing from



A general view of the buildings of the Windmill Press at Tadworth, Surrey, England.

left to right and downwards in order, thus ensuring that every section is present and in correct order. Girls collect these from the folding machines and place them in a bundler, where they are squeezed together by pneumatic pressure. They are then transferred to the sewing machines, where ingenious mechanical methods are used to apply tapes and to sew each of the signatures together and to the tapes. All these machines have individual electric drive. From there, the book, which now shows signs of appearing in a completed form, is taken to a 3-knife guillotine which trims the three sides—that is, those other than the back, which is now sewn—to the correct dimensions. In order that a book may lie flat when opened, and to enhance its appearance and improve its strength, it is necessary that the back should be rounded, and here a machine called a "rounder and backer" is used to produce, by heavy mechanical pressure, the necessary roundness of the spine. The book is now ready for binding.

All the machines are driven electrically, and as well as the necessary D.C. motors many of them employ electrically heated glue pots, and in some cases small compressors or suction pumps for paper feeding purposes are also used.

It will be seen from the brief description outlined above of the processes involved in producing a book, that in the case of a Press where electric power is used throughout, and where —as in the case of the Windmill Press—continuous working is adopted, from Monday morning until Friday evening throughout each day and night, the supply must be entirely reliable and free from fluctuations which could upset any one part of the process and thus hold up every other department. For instance, prolonged low voltage on the elements used for heating the metal would upset the operation of the linotype and of the foundry; while high voltage could cause considerable trouble with rotary machinery involving paper handling.

The power house, which supplies the whole needs of the Press, except for a standby A.C. supply purely for lighting at weekends, is equipped for its main source of current, with two "English Electric" 3-cylinder "K" type Diesel engines, driving 110 kw. D.C. generators. One of these engines was installed during the war, and for three years ran entirely alone, and never at any time gave any sort of trouble or needed repairs other than routine overhauls.

There are three other small sets in the power house, of 50 hp., 20 hp. and 8 hp., which have been used for emergency purposes, and for occasional weekend running, but the load on the plant is now exactly full load for one of the "English Electric" generating sets, and the rapid starting facilities available—the engineers mentioned that half-a-minute is all that is necessary to bring on a new set in an emergency—mean that it is now considered that the power house is completely equipped for regular reliable running. The second set was installed early in 1947. The engines follow the company's standard design for this type of equipment. The later model has oil governing, while the earlier engine has the standard type of mechanical governor, both of which have proved sufficiently sensitive to give a voltage variation of not more than plus and minus 2½ volts under all loading conditions. Starting is by compressed air, and cooling water is obtained from a pleasantly designed pond, admirably suited to the rustic surroundings outside the engine room.

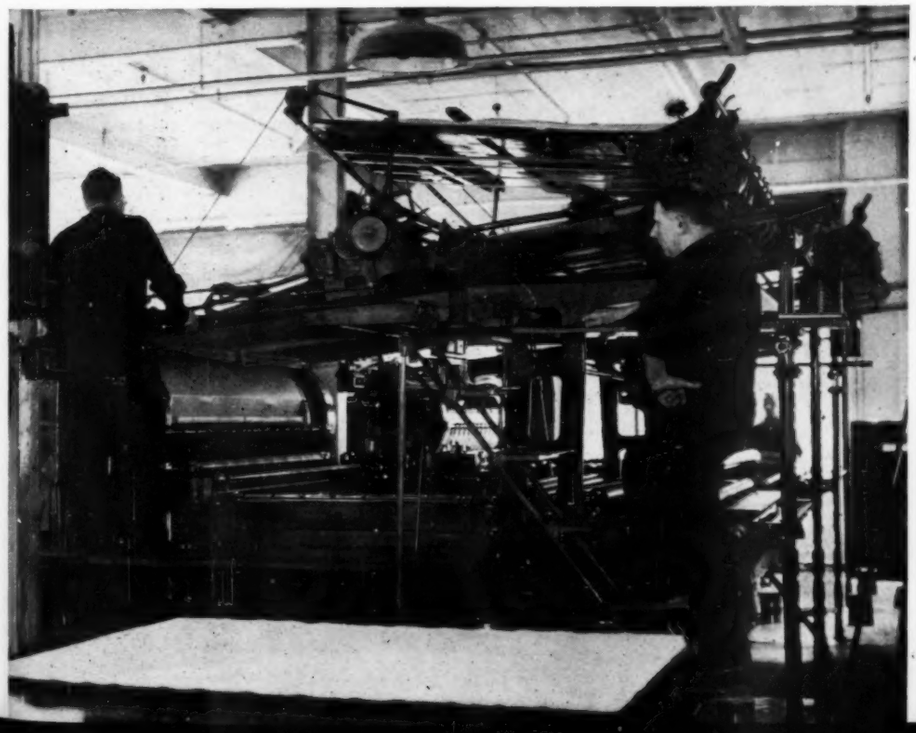
The exhaust gases from each of the two Diesel engines pass through Clarkson boilers on their way to the atmosphere, and this method of utilizing the heat which would otherwise be wasted enables the whole of the buildings to be heated by hot water from this source. Fuel oil is stored in underground tanks in the grounds, and a stock of 3,600 gallons is normally kept. Above each engine is a service tank, holding approximately 60 gallons, which is filled by hand from the main tanks.

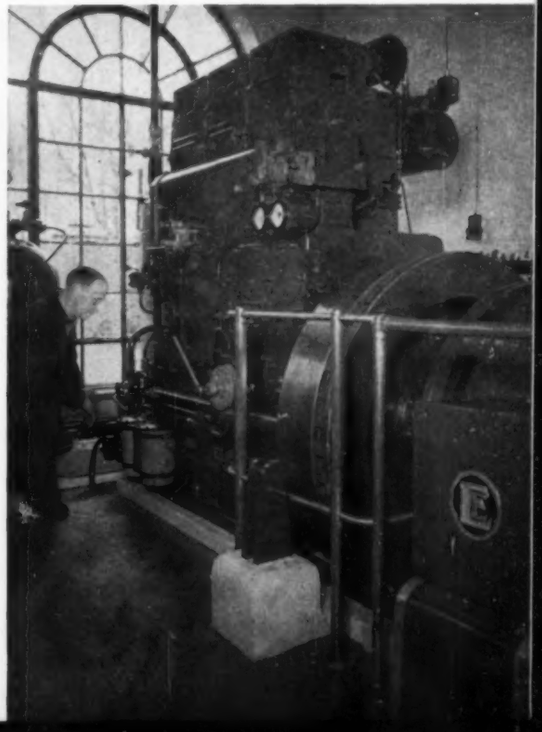
The consumption per unit generated is approximately 0.6 lbs. of fuel per kwh., and while certain factors make it difficult to give an exact figure of the cost per unit, this is estimated at an all-in cost of 1½d. per kwh. Neither noise nor vibration is in any way objectionably noticeable, even when standing close to the Diesel sets, and a very high standard of decoration and general cleanliness is maintained in the engine room without undue difficulty.

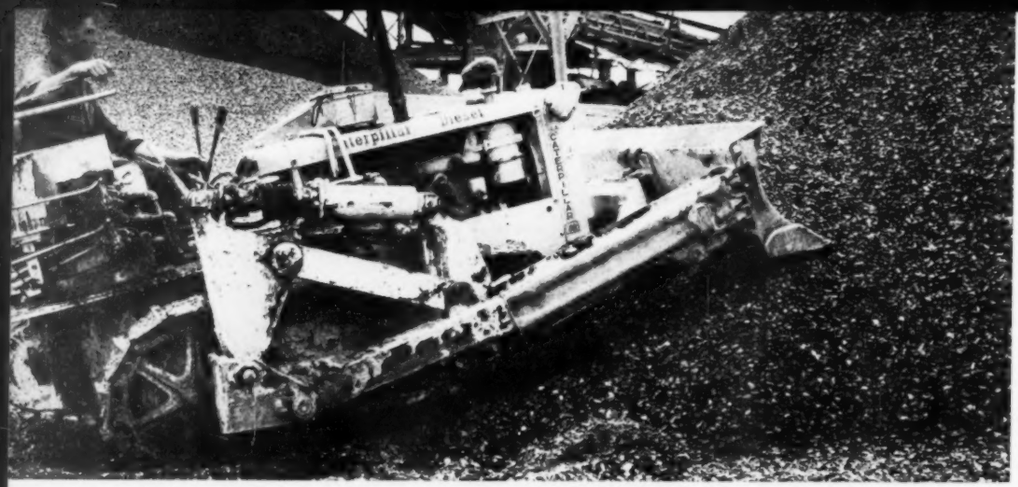
The Chief Engineer of the Press, R. A. Adams —to whose courtesy we are indebted for facilities for writing this article and for taking the photographs—paid tribute to the reliability of the generating plant during the war years, when the one "English Electric" generating set, which at that time was the sole main source of power, ran uninterruptedly without ever giving trouble, for some three years.

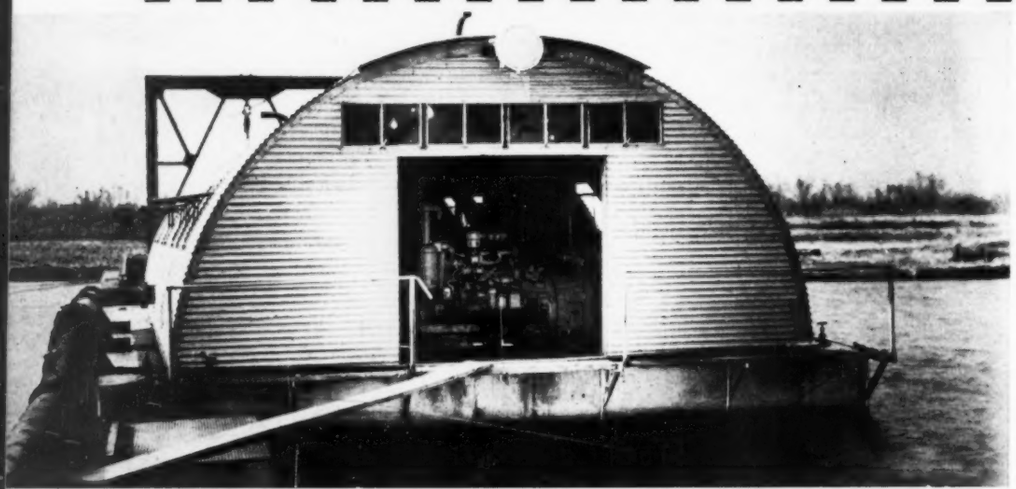


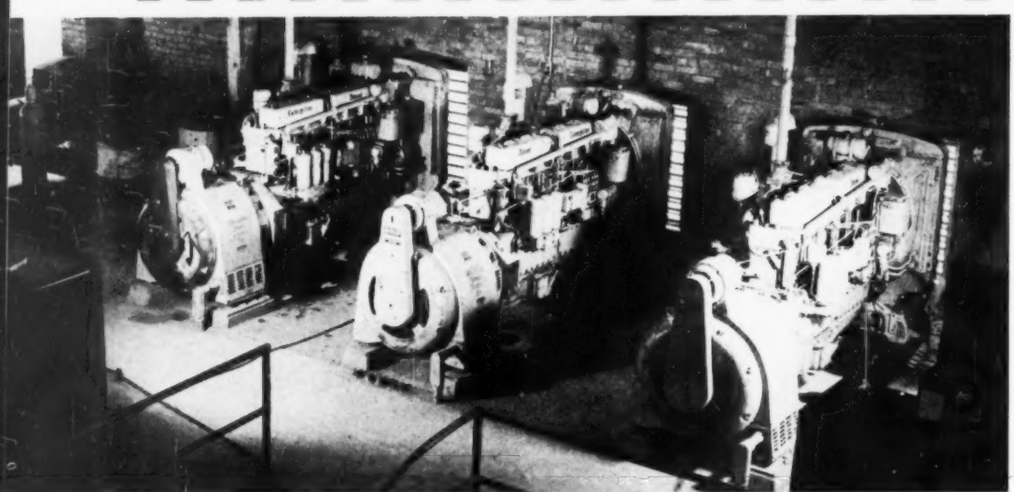
Below, left: One of the printing machines at the Windmill Press. Right: One of the two Diesel engines, driving 110 kw, D.C. generators.







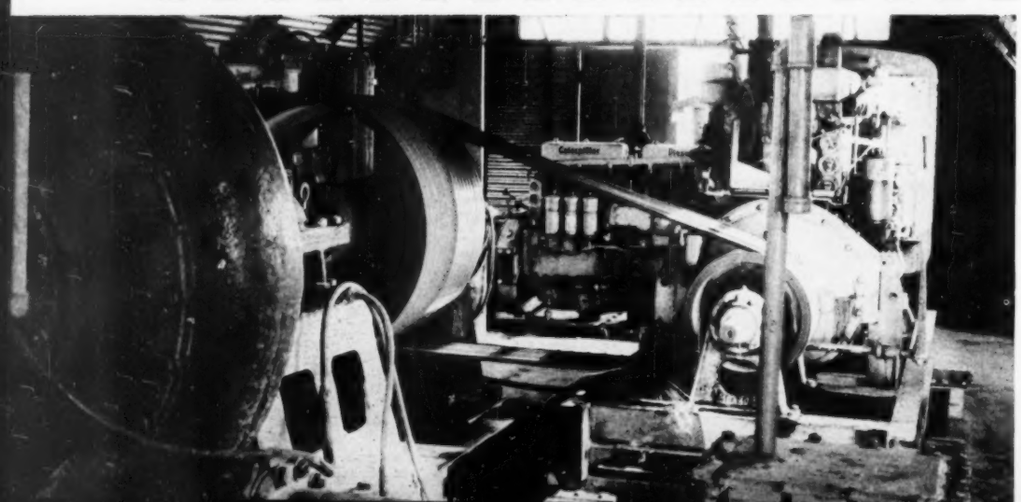




Above: General view of the Terry Carpenter Ltd., crushing plant showing feed line from barge, center foreground, conveyors to stock piles, right, and discharge line, upper center. Power for all operations is from Caterpillar Diesels.

Top, left: Diesel tractor with bulldozer trims up stock piles of six sizes of sand and gravel used in Terry Carpenter, Ltd. cement block plant at Scottsbluff, Nebraska.

Second from top: Floating Diesel pump house moving sand and gravel up to 1700 ft. to crushing plant.



Third: Three Caterpillar Diesel-electric generating sets supply power for producing 50,000 cement blocks a week.

Left: Inside view of the Quonset barge, seen above, showing Caterpillar Diesel pumping and generating engines.

# *DIESELS FOLLOW THROUGH . . .*

## in building material processing

TERRY Carpenter, Inc., Scottsbluff, Nebraska, has provided thousands of concrete blocks to construction projects about the country during the post-war building boom and has maintained high production figures by coordinating all facilities of the organization to serve as both supplier and manufacturer.

To supply the necessary aggregate for the manufacture of cement blocks, the company maintains its own sand and gravel pit and crushing plant near the site of the finishing plant and by such methods has been producing a weekly average of 50,000 cement blocks for a hungry market.

The crushing plant produces sand and six grades of gravel at the rate of 150 yards per hour. The aggregate is pumped from the gravel pit through a 12-inch pump set up and powered from a quonset-type pump-house erected on a barge. From the pit it is carried to the crushing plant for processing into the various grades of aggregate.

Two "Caterpillar" Diesel engines and one Diesel Electric set power the pump conveyor and all driven machinery of the crushing plant. Outside the plant itself "Caterpillar" Diesel track-type tractors perform the "house keeping" chores of maintaining stockpiles of the various grades of gravel. At the nearby cement block plant, three more Diesel Electric sets provide the necessary power for processing of the blocks, which are formed and pressed under 150 pounds pressure at a temperature of 366 degrees.

# DIESELS IN UNDERGROUND MINING

## Part I

*By* D. HARRINGTON *and* J. H. EAST, JR.

*Editor's Note: This article dealing factually with the application of Diesel engined locomotives to mining operations is published by permission of the Director, Bureau of Mines, U. S. Department of the Interior. The authors—D. Harrington, Chief, Health and Safety Branch, Bureau of Mines and J. H. East, Jr., Senior Mining Engineer, Bureau of Mines—are well equipped to discuss this interesting phase in Diesel application. The article will appear in two successive issues of DIESEL PROGRESS. Part I is presented in this issue.*

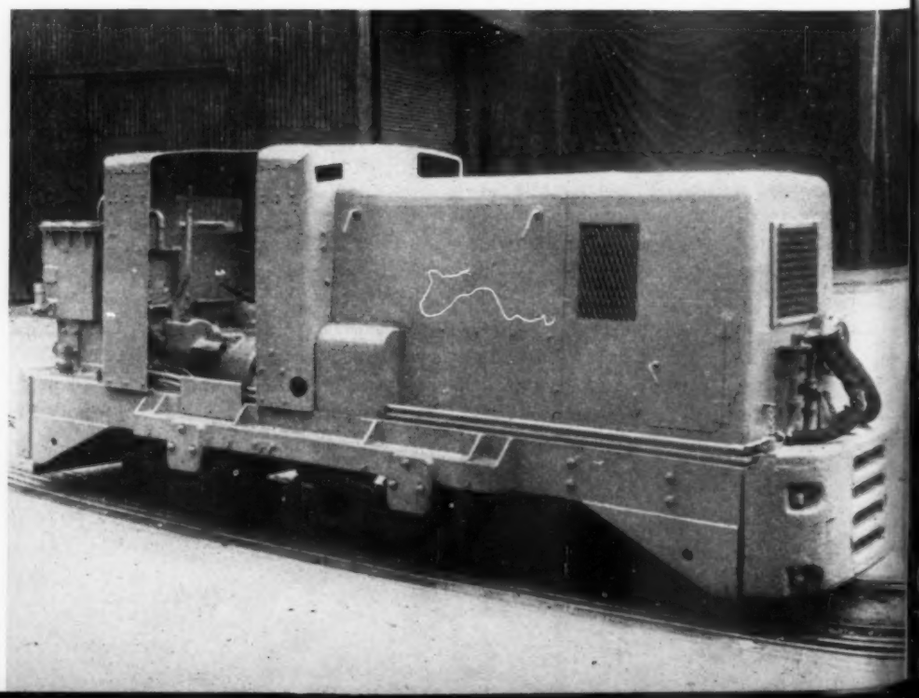
DIESEL-POWERED equipment can be used safely in underground mining if certain feasible but very important precautions are taken, but any equipment installed underground introduces hazards that did not exist before; it is the purpose of this paper to point out hazards as well as safety features involved in the use of this type of power equipment underground. There is probably no other type of mining equipment now being introduced into American mines about which less is known and about which there is more misinformation. The foreign technical journals have devoted considerable space to the use of Diesel locomotives in European mines, and the subject has been given limited amount of mention in the technical magazines in the United States. The Bureau of Mines has conducted extensive tests of the gases produced in the exhaust of Diesel engines under varying conditions and in differing atmospheres.

The exhaust of the Diesel engine consists of the products of combustion of the fuel oil and the air in which it is burned. The usual fuel oil consists of approximately 85 per cent carbon and 15 per cent hydrogen and possibly small quantities of sulfur. When the Diesel engine is operated within its normal range of power output, virtually all carbon in the fuel oil burns to carbon dioxide and the hydrogen to water; if sulfur is present it burns to oxides of sulfur. A small amount of the carbon in the fuel oil does not burn to carbon dioxide with the result that a relatively small amount of carbon monoxide is always present in the exhaust generated by Diesel engines. Aldehydes, which constitute a part of the exhaust, are produced by partial combustion of fuel oil in a Diesel-engine cylinder; these largely are responsible for the odor associated with the exhaust. Oxides of nitrogen also are formed by the reaction of the oxygen and the nitrogen of the air inside the cylinder during combustion. The chemical reaction takes place because of the high temperature and pressure in the cylinder during combustion; the fuel oil is not believed to enter into the reaction.

The composition of Diesel exhaust gases depends on the air and fuel in the cylinders during combustion or, in other words, the air:fuel ratio. The ratio is expressed in terms of pounds of air per pound of fuel. The maximum ratio is at full speed and load, as when the engine is working at capacity; this fact is significant, because the weight of the exhaust gases is the maximum when the engine is working at capacity and requires full throttle or injection of fuel oil.

The air:fuel ratio varies with the elevation above sea level where the unit is operating. A Diesel engine that is so adjusted so that it is in perfect working condition at an altitude of 1,000 feet and the exhaust gases are well within permissible limits will not be adjusted to work at an altitude of 6,000 feet, because the air is lighter than at the 1,000-foot altitude; therefore an adjustment must be made in the amount of fuel injected into the cylinders to restore the air:fuel ratio. The air:fuel ratio of 20 pounds of air per pound of fuel is selected generally as the one most suitable for best operation at full load and full speed when a Diesel engine is operating underground because at this ratio the minimum quantity of toxic gases is produced in the engine exhaust.

Principal gases composing the Diesel exhaust are: Carbon dioxide, carbon monoxide, oxides of nitrogen, aldehydes, oxides of sulfur, oxygen, nitrogen and smoke. Carbon dioxide is a colorless, odorless gas; it is heavier than air and may accumulate near the floor of a tunnel or mine working that is inadequately ventilated. The maximum carbon dioxide content of air in which a Deisel engine can be operated safely is 1 per cent, but 0.5 per cent is the preferable high limit. Carbon monoxide is a colorless, odorless gas; it is slightly lighter in weight than air and diffuses easily into the surrounding atmosphere, but it may accumulate in or toward the top of a working place that is not well ventilated. Carbon monoxide in the exhaust gas is formed by the incomplete oxidation of the fuel oil; contrary to the belief of many people, carbon monoxide is always present in the exhaust of a Diesel engine. It is extremely hazardous to breathe even in small amounts; a concentration of 0.04 per cent in air that is breathed causes headache and discomfort within 2 or 3 hours.



"Oxides of nitrogen" is the term applied to the oxides of nitrogen (NO and $NO_2$) or mixtures of them. Inhalation of these gases causes the formation of nitric and nitrous acids in the respiratory system; only a small percentage of oxides of nitrogen in the atmosphere may ultimately cause death. The relative toxicity of oxides of nitrogen is shown by comparison with carbon monoxide. An atmosphere containing 0.5 to 1.0 per cent of carbon monoxide is likely to be fatal to a human being in less than 30 minutes of exposure, whereas as little as 0.07 per cent of oxides of nitrogen may be fatal in the same time. These figures indicate the danger from exhaust gas when precautions are not taken while Diesel engines are operated in confined places, though this hazard can be overcome if suitable available precautions are used.

Chemically, an aldehyde is defined as a colorless, mobile, and very volatile material obtained from alcohol by moderate oxidation. Aldehydes have a characteristic sharp, suffocating odor and even in exceedingly small quantities irritate the eyes and respiratory passages. Their presence in exhaust gas is largely responsible for the so-called acrid exhaust from Diesel engines; it generally is the main odor that can be detected in exhaust gas, because the other gases are odorless, except that slight traces of oxides of sulfur may be present. The odor of aldehydes resembles that of formaldehyde, which is the aldehyde of formic acid.

Various private and governmental groups have determined the maximum limit of certain toxic gases considered permissible in working places. The different groups do not agree in all instances; however, the standards established by all of the groups are feasible to meet insofar as the operation of Diesel engines underground is concerned. These limits are shown in table 1.

**Table 1.—Maximum Permissible Limits of Toxic Gases**

| Group | Carbon dioxide | Carbon monoxide | Oxides of nitrogen | Aldehydes |
|---|---|---|---|---|
| | Percent of volume | | Parts per million | |
| Bureau of Mines | 1.0 | 0.01 | 25 | 10 |
| U. S. Public Health Service | .5 | .01 | 25 | 10 |
| American Standards Association | — | .01 | 25 | 10 |
| New York | .5 | .01 | 40 | 5 |
| Oregon | .5 | .01 | 25 | 10 |
| Utah | .555 | .01 | 10 to 40 | 20 |
| Massachusetts | — | .01 | 10 | 10 |

The successful use of a Diesel engine underground or in confined places where men must work depends largely upon positive and efficient devices that control or remove some of the toxic gases in the exhaust that otherwise would be discharged into the surrounding atmosphere; however, a very important adjunct is the maintenance of an adequate flow of pure air in the vicinity of the engine. If gas or other flammable material is present in the atmosphere, it is imperative that flame arresters be provided on both the intake and exhaust of the engine and that ultra-high temperatures that may ignite accumulations of methane be reduced below the ignition temperature of that gas.

Devices have been perfected that provide protection against some of the hazards of the exhaust gas from a Diesel engine and from the possible ignition of methane-air mixtures; these devices have been in use for many years in European countries, and the considerable number of Diesel locomotives used underground in these countries in both coal and non-coal mines indicate the effectiveness of the precautionary devices or methods.

Present-day devices for treating exhaust gas are designed to definitely lower the temperature of the exhaust gas, to absorb some of the toxic gases, to remove most of the smoke and odorous and irritating constituents, and to dilute the constituents remaining by admixing them with comparatively large quantities of air before the final exhaust is discharged into the atmosphere. The design of some Diesel locomotives manufactured in England provides for mixing the exhaust gas of the engine with 30 to 40 times its volume of fresh air before the final exhaust is discharged into the atmosphere.

The simplest type of device to treat exhaust gas is a bath of water placed between the engine exhaust ports and the pipe that discharges the exhaust gas into the surrounding atmosphere. Water seems to be the best available absorbent of the toxic and odorous constituents of exhaust gas. It is important to remember that carbon monoxide is not absorbed by such types of scrubbers. There are many variations in the design of the scrubbers; some designs provide for shutting off the fuel supply automatically and applying the brakes if the water supply becomes low or if the temperature of the exhaust gas exceeds 160°F.

The most common flame arresters used on the exhaust and air inlet of a Diesel engine are the labyrinth type; this consists essentially of a multiple metal-place device that provides narrow passages for the escaping exhaust gas. Other designs have porcelain rings instead of the metal plates and thus offer less resistance to the exhaust gas. Flame arresters must be kept clean or changed frequently, since they tend to clog with soot and build up back pressure.

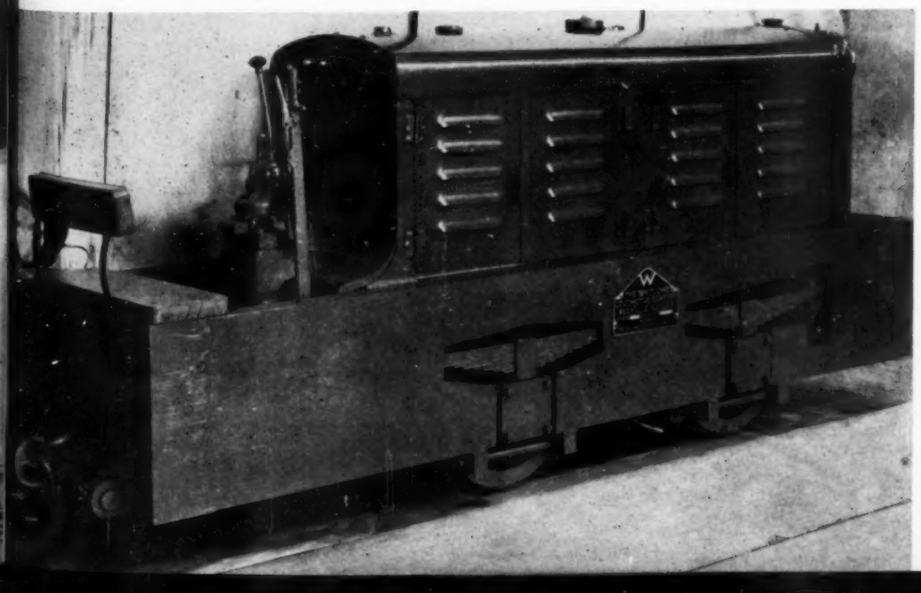
The quality of air ventilating places where a Diesel engine operates is of utmost importance; the atmosphere in underground mines frequently contains higher than normal amounts of carbon dioxide and less than normal amounts of oxygen. In driving tunnels in some rock formations it is not unusual to encounter methane, a gas found in many coal mines; this must be recognized when calculating the ventilating requirements before a Diesel engine is placed in service underground.

When a Diesel engine is operated in an underground atmosphere containing less than 20.93 per cent oxygen (normal air), the air:fuel ratio at a given speed and fuel consumption will be greater than that corresponding to operation in normal air.

An atmosphere containing approximately 1 per cent of carbon dioxide may not be dangerous

Latest type Ruston mine locomotive for use in gassy mines. It is equipped with exhaust conditioner and flametrap

Seven ton Whitcomb mine locomotive powered with 35 hp Buda Diesel now in service in Turkish coal mines



under ordinary conditions, but a Diesel engine cannot be operated safely when the atmosphere contains more than 1 per cent carbon dioxide; in fact, Diesel engines should be operated in atmospheres that are virtually normal.

### *Diesel Locomotives in European Mines*

Diesel mine locomotives have been used with success in continental Europe for at least 18 years; most of these are main-line haulage units. Diesel locomotives were first permitted in underground gassy coal mines in Great Britain in 1939, but more than 40 units were in operation in 1946.

Complete statistics are not available for all European countries, but in Belgium 62 per cent of all mine locomotives were Diesel-powered in 1939; France used 380 Diesel mine locomotives in underground mines in 1937. Recent statistics show a total of approximately 1,300 Diesel locomotives in use in European mines.

Flameproof mine locomotives manufactured in Great Britain for use in coal mines range in size as follows:

| Brake horsepower | Weight, tons | Purpose |
|---|---|---|
| Less than 20 | 2.5 | Replaces mules |
| More than 20 | 4 to 5 | Gathering |
| 25 | 7 | Gathering |
| 50 | 10 | Man-trips and coal |
| 100 | 15 | Main-line haulage |
| 200 | 20 | Main-line haulage |

These locomotives are required to meet certain tests before they can be used underground. Locomotives conforming to the requirements of the Ministry of Fuels are given "Buxton Certificates" which are similar to the permissibility approvals given by the Bureau of Mines.

Exhaust-gas conditioners are required in virtually every country in Europe, but emphasis is placed on excess ventilation of the haulage ways.

Typical specifications of the 25-, 50-, and 100-hp. Diesel mine locomotives manufactured in England are shown in table A.

Some of the desirable features for Diesel locomotives intended for use in underground metal and nonmetallic mines in the United States are listed below:

(1) Metal and nonmetallic mines usually do not require flameproof Diesel mine locomotives, unless there is a possibility of the presence of an explosive gas, as in some western tunnels and mines. However, flame arresters on the exhaust are desirable in any type of mine, as they minimize a possible fire hazard.

(2) A Chemical method of absorbing the aldehydes and oxides of nitrogen in the exhaust gas is desirable, but so far such a method has not been devised. Water absorbs the aldehydes, but the water in the conditioner must be changed frequently enough to prevent it from becoming saturated and thus losing its absorbent qualities.

(3) A chemical method of converting carbon monoxide in the exhaust gas to carbon dioxide, or of absorbing the carbon monoxide, is desirable but unfortunately not yet available.

(4) The exhaust-gas conditioner should function efficiently for at least one shift without requiring attention, such as changing the water or adding chemicals.

(5) The exhaust gas, after leaving the conditioner, should be diluted with air before discharging into the atmosphere. This reduces the hazard from toxic gases to persons in the immediate vicinity of the mine locomotive.

(6) Diesel mine locomotives should be equipped with at least two, and possibly three, independently operated brakes. Air brakes, as well as hand-operated brakes, are desirable.

**Table A—Diesel-Mine-Locomotives Specifications**

| Horsepower | 25 | 50 | 100 |
|---|---|---|---|
| Typical track gage | 2'0" | 2'6" | 2'6"—3'0"—3'6" |
| Diameter of coupled wheel | 1'8" | 2'0" | 2'0" |
| Wheel base | 3'0" | 4'0" | 5'3" |
| Height, over-all | 5'0" | 5'0" | 5'6" |
| Width, over-all | 3'4" | 3'11" | 4'6"—4'9"—5'3" |
| Length, over-all (without coupling) | 11'3½" | 13'0" | 14'0" |
| Maximum power: | 25 h.p. | 50 h.p. | 100 h.p. |
| Speed of engine, r.p.m. | 1300 | 1300 | 1700 |
| Speed m.p.h., 1st gear | 3.25 | 3.00 | 4.00 |
| 2nd gear | 5.05 | 4.66 | 6.00 |
| 3rd gear | 8.56 | 7.90 | 9.25 |
| 4th gear | 12.46 | 12.25 | 14.50 |
| Fuel capacity, gallons | 7 | 13 | |
| Weight | 4 tons 11½ cwt. | 8 tons 10 cwt. | 15 tons |
| Maximum axle load | 2 tons 7 cwt. | 4 tons 6 cwt. | 5 tons |
| Tractive effort, pounds, | 1st gear 2,450 | 5,310 | 8,000 |
| | 2nd gear 1,580 | 3,420 | 5,200 |
| | 3rd gear 930 | 2,020 | 3,400 |
| | 4th gear 640 | 1,300 | 2,200 |
| Minimum radius of curve, | feet 30 | 30 | 80 |

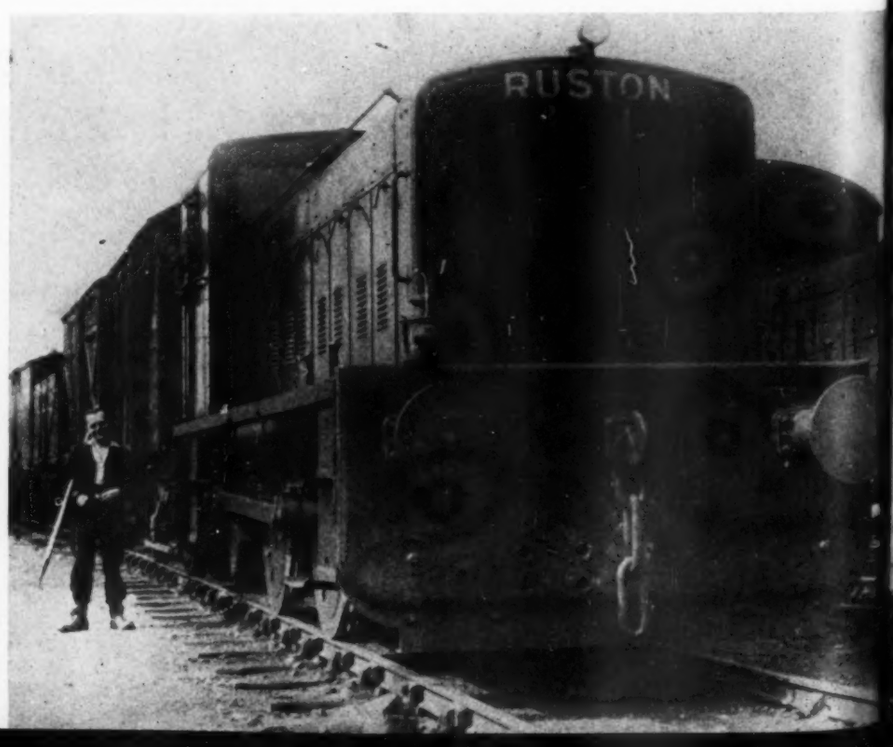
(7) The spring suspension of the locomotive should be designed to provide maximum stability on rough, uneven track. Many mine tracks are poorly maintained, resulting in low joints and uneven tracks, which may cause derailment.

### *Use of Diesel Mine Locomotives in the United States*

Diesel locomotives are used in the United States to only a very limited extent. In August 1947, insofar as information was available, only five Diesel mine locomotives were operating underground in the United States; two of these were

Ruston shunting locomotive equipped with 165 hp. Diesel engine

American manufactured Diesel mine locomotive in a western lead zinc mine, right



in metal mines, one in an underground limestone mine, one in a gypsum mine, and one in a clay mine.

In 1940 Diesel locomotives were used underground during the driving and lining of the Delaware River Aqueduct in New York, and much information was obtained by the Bureau of Mines and the Division of Industrial Hygiene, New York Department of Labor, in connection with this enterprise. This information has been published by the Bureau of Mines and the technical press.[1]

Five Diesel locomotives, weighing 14 tons each, were used on this project; the engines developed 160 hp. at 1,600 to 1,750 rpm. Methane was encountered in some of the tunnels, so the engines were required to be of the flameproof type equipped with labyrinth-type flame arresters on the air inlet and the exhaust. The exhaust-gas conditioners, or scrubbers, washed and cooled the exhaust gas while passing through a water spray. The exhaust gas was diluted with air from behind the radiator before it was discharged into the atmosphere. An air current of 10,000 cfm. per minute was found desirable for each Diesel locomotive to avoid objectionable gas concentrations.

[1] Harris, William B.; Greenburg, Leonard, and Werner, Gustav, Diesel Engines in Tunneling Operations: Trans. Am. Inst. Min. and Met. Eng.; vol. 153, 1943. Stiefel, Fred W., Operation of Diesel Locomotives Underground: Trans. Am. Inst. Min. and Met. Eng., vol. 153, 1943. Ash, S. H., and Naus, L. L. Use of Diesel Engines in Tunnels: Bureau of Mines Inf. Circ. 7222, 1942, 26 pp. Holtz, J. C., Berger, L. B., Elliott, M. A., and Schrenk, H. H., Diesel Engines Underground. I: Bureau of Mines Rept. of Investigations 3508, 1040, 48 pp.

The maximum haulage distance was 5 miles on an adverse grade for the cars loaded with concrete. Each train hauled 20 cubic yards of concrete, a total of 40 tons. The total distance covered in 1 month was 11,017 miles, and the cost for the month was $0.0222 per ton-mile, covering all expenses.

A Diesel locomotive has been in service as a main-line haulage unit at a western lead-zinc mine for more than a year, and the service is reported to be satisfactory. The elevation of the portal of the tunnel is 10,600 feet above sea level. The locomotive as originally installed weighed 5 tons, but its weight has since been increased to 6 tons to give the locomotive more traction. The Diesel engine develops 65 bhp. at sea level but on account of the altitude develops 55 bhp. at the elevation of the tunnel portal.

Some pertinent data relative to this locomotive are tabulated below:

| | |
|---|---|
| Height, over-all | 4'6" |
| Length, over all | 12'0" |
| Width, over-all | 3'3" |
| Track gage | 2'0" |
| Brakes | Westinghouse air brakes |
| Speed | 3 speeds in either direction |
| Fuel consumption, 8 hours | 6 gallons |

The mine cars are 60 cu. ft. Granby type and have a capacity of 3 tons of ore; the empty car weighs 2 tons. The locomotive normally pushes 15 empty cars into the mine and returns with 15 loaded cars; it has brought out 120 loaded cars in an 8-hour shift under actual working conditions. The estimated capacity of the mine locomotive is said to be 500 ton-miles of loaded cars and 200 ton-miles of empty cars, or a total of 700 ton-miles in 8 hours. The tunnel grade ranges from 0.50 per cent to almost 2.0 per cent in favor of the load.

The locomotive is equipped with air brakes and two hand-operated brakes. The air brakes are on the driving discs; one emergency brake is on the four brake shoes that contact each wheel, and the other brake is on the transmission. Owing to the heavy loads and steep grades coming out of the tunnel, more than ordinary braking power is desirable; a special brake car, weighing 3 tons, is fitted with air brakes on all four wheels and is coupled to the engine at all times.

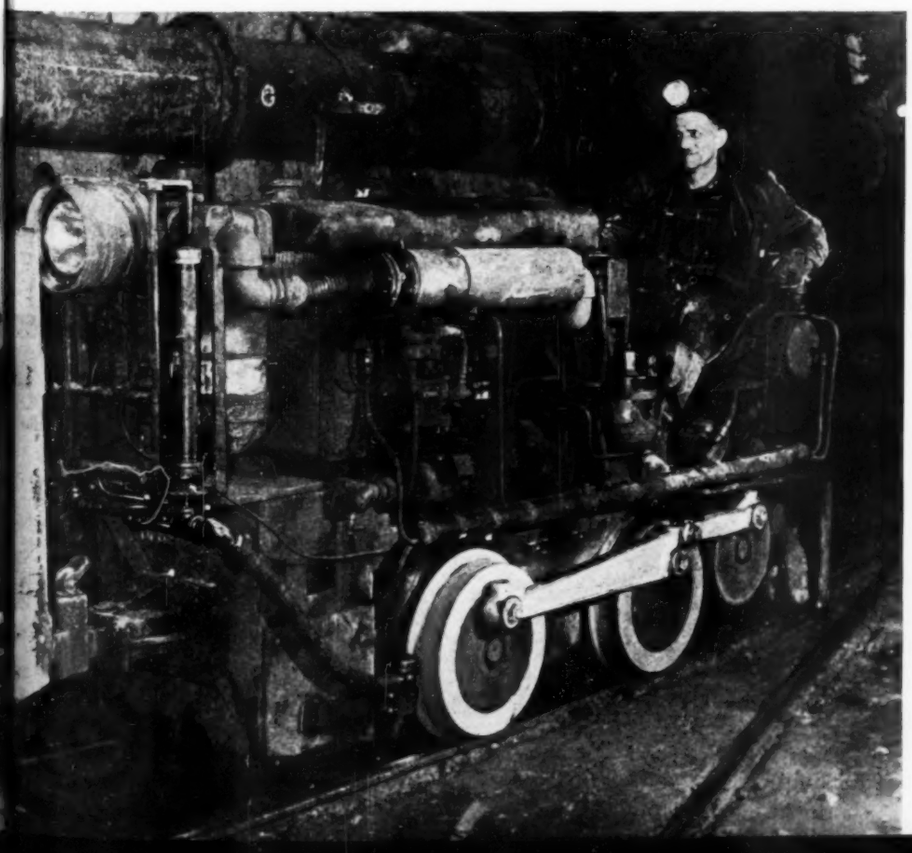
The tunnel workings were ventilated by means of a suction fan on the surface and an 18-inch steel pipe; a booster fan was installed 8,500 feet in from the portal, and it was stated that 5,000 cubic feet of air per minute was delivered to the headings. A raise driven to connect with old mine workings above has been completed, and the ventilation is improved; the State Mining Department restricted the use of the Diesel mine locomotive to the first 8,500 feet from the portal when the Diesel was first installed.

Samples of the general mine air taken at the end of the Diesel run, 8,500 feet from the portal of the tunnel, were analyzed as follows:

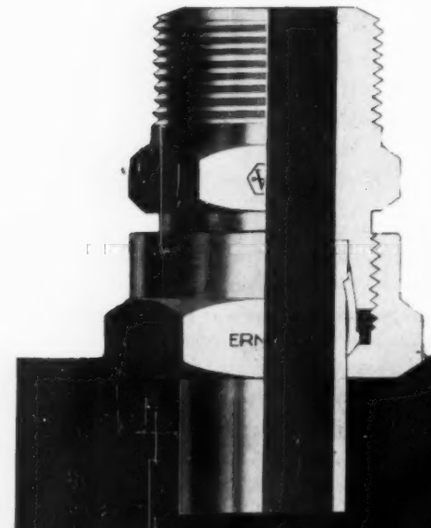
| | 1 Percent | 2 Percent | 3 Percent |
|---|---|---|---|
| Sample Number | 20.25 | 20.12 | 19.98 |
| Oxygen | 79.34 | 79.41 | 79.56 |
| Nitrogen | .41 | .47 | .46 |
| Carbon dioxide | .00 | .00 | Less than .005 |
| Carbon monoxide | | | |
| Total | 100.00 | 100.00 | 100.00 |
| Oxides of nitrogen, parts per million | 17 | 13 | 28 |

The air analyses indicated the need of better ventilation of the tunnel; the quality of air has improved since the raise connection was completed.

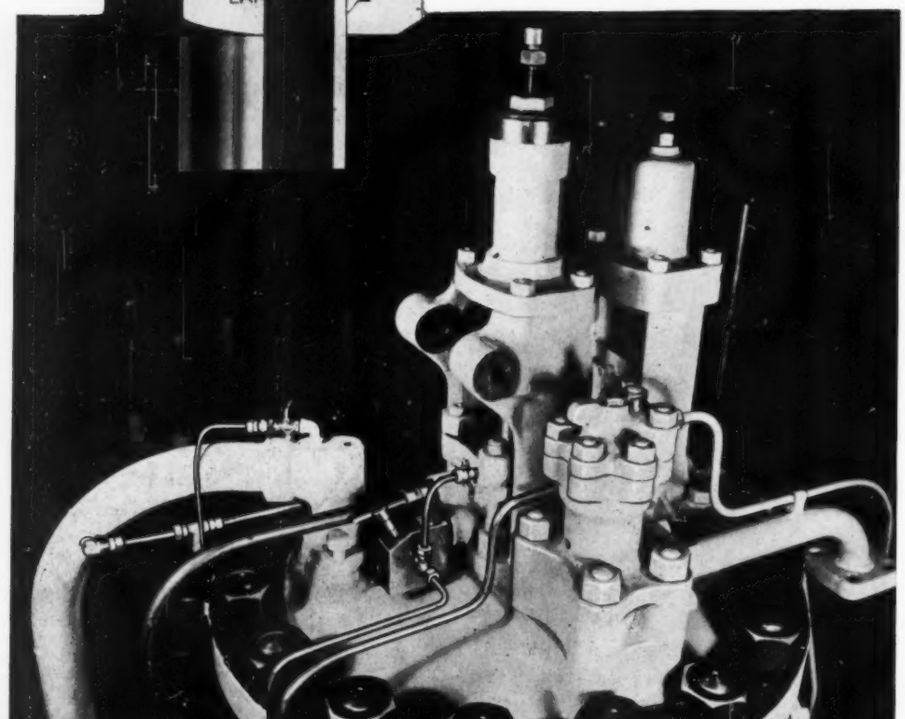
A Diesel locomotive is used as a haulage unit in an underground limestone mine in one of the western States; this is believed to be the first small Diesel mine locomotive used underground in the United States. The locomotive has been in constant use for over 2 years. The altitude at the portal of the tunnel is 6,550 feet above sea level. Two steeply dipping limestone beds are opened by a crosscut tunnel 8 feet by 14 feet in cross section; drifts are driven right and left at the intersection of each limestone bed. The farthest bed of limestone is intersected by the crosscut tunnel 3,500 feet from the portal. An average of 6,500 tons of rock a month is hauled from the tunnel.



# SEAL TIGHT FITTINGS FO



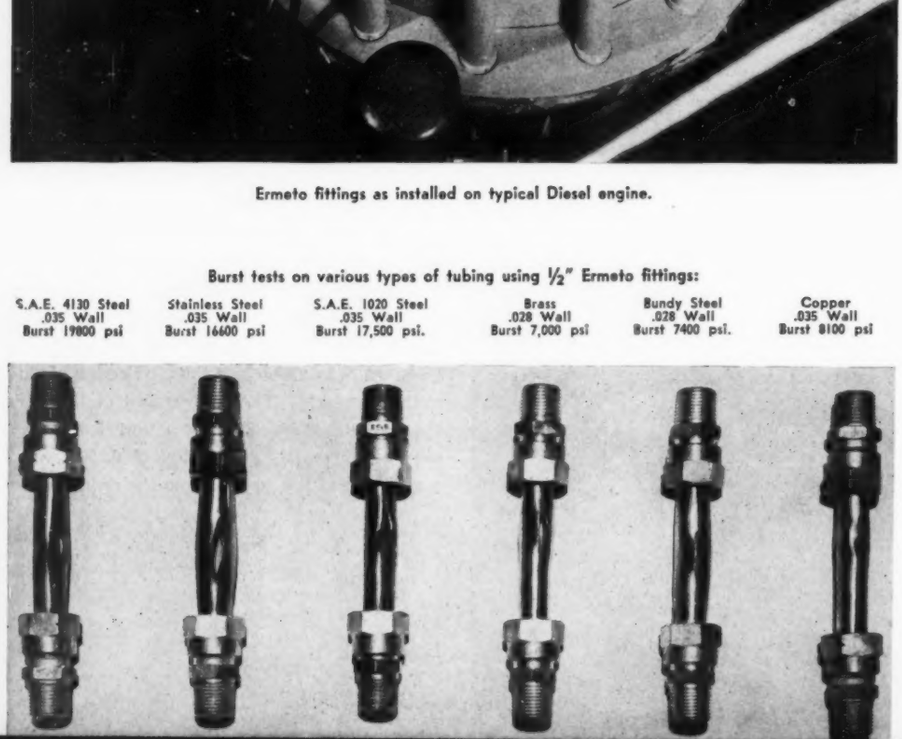
Cutaway view of Ermeto fitting.



Ermeto fittings as installed on typical Diesel engine.

Burst tests on various types of tubing using ½" Ermeto fittings:

| S.A.E. 4130 Steel .035 Wall Burst 19800 psi | Stainless Steel .035 Wall Burst 16600 psi | S.A.E. 1020 Steel .035 Wall Burst 17,500 psi. | Brass .028 Wall Burst 7,000 psi | Bundy Steel .028 Wall Burst 7400 psi. | Copper .035 Wall Burst 8100 psi |
|---|---|---|---|---|---|



THE Ermeto* principle, originally conceived by Hans Kreidel back in 1932, has now been improved for use on hydraulic, oil, water, gas, fuel and air lines. The fitting has been changed to fit American standards of measurement and thinner tubing sections and has been adapted for aircraft, industrial, automotive, refrigeration, marine and Diesel applications. The first Ermeto fittings were made from B 1113 steel which was satisfactory for general industrial use . . . with the advent of large scale aircraft production, Ermeto fittings were constructed of aluminum which offers great savings in weight. Stainless steel is also used to provide a non-corrosive fitting for the chemical, food processing, and beverage industries. Steel, aluinum and stainless steel Ermeto fittings meet requirements for all fields of use. It is now possible to secure a tight fit for any metallic tubing joint which must stand high pressures.

As shown in the cut-away sections of the Ermeto fitting, it can be seen that the fitting features a cutting ring which provides an air, liquid and vacuum seal. Freedom from leakage is provided by the radial compression of the cutting ring upon the longitudinal movement of the ring which brings the ring's cutting edge into shearing engagement with the tubing, causing a bead of metal to be sheared up on the outside diameter of the tubing against which the ring seals and holds. In simpler language, this means that the sealing and tube holding features of the Ermeto fitting are a result of the cutting ring which grips the tube as the fitting nut is tightened. The seal produced by this cutting action is completed by the seal of the fitting shoulder and the ring against the fitting bevel. In effect, the Weatherhead Ermeto fitting seals three ways.

During routine tests Weatherhead laboratory engineers learned that the cutting ring, nut and body also reduce vibrational fatigue.

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** *Chief Engineer, The Weatherhead Company*

* *Ermeto is a registered trade mark. Ermeto fittings manufactured by The Weatherhead Company under license, are covered by U. S. patents and numerous pending patent applications.*

# FOR DIESEL FUEL LINES

*By* N. J. PAQUIN**

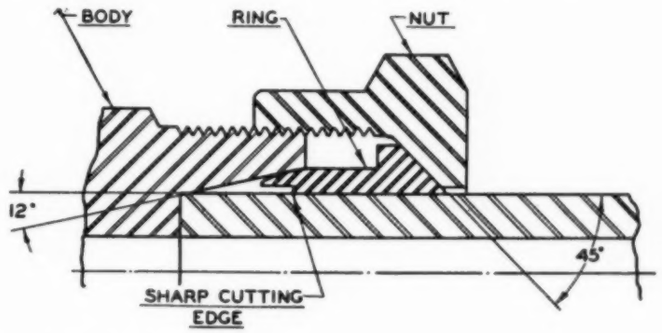
Further laboratory tests show that the fitting withstands pressures beyond the burst point of the tubing to which it is attached, and that it bears up under temperature and impulse cycle tests. In stainless installations, use of Weatherhead stainless Ermeto fittings reduces the overall installation cost because of the fact that it is only necessary to use light walled stainless tubing in place of heavy walled iron pipe. This reduces the material cost by 50 per cent and also eliminates the labor cost necessary in threading the iron pipe. Flaring the stainless tubing, a difficult job with this hard metal, is eliminated.

During the war Weatherhead engineers found that aircraft type vibration was best withstood by re-proportioning the Ermeto fitting, and out of these findings grew the aluminum Ermeto fitting, known as the ER series. This simple fitting saved hours of manufacturing and maintenance time on aircraft aluminum tube lines, which suffered terrific vibrational strain during combat operations. Since there is no soldering, welding, threading or flaring involved in assembly, the Weatherhead Ermeto fitting can be used again and again without loss of any of its sealing properties. Laboratory tests on the fitting are made in accordance with strict Army and Navy requirements that the fitting withstand minimum of 15 tightenings and retightenings. These tests are successfully met.

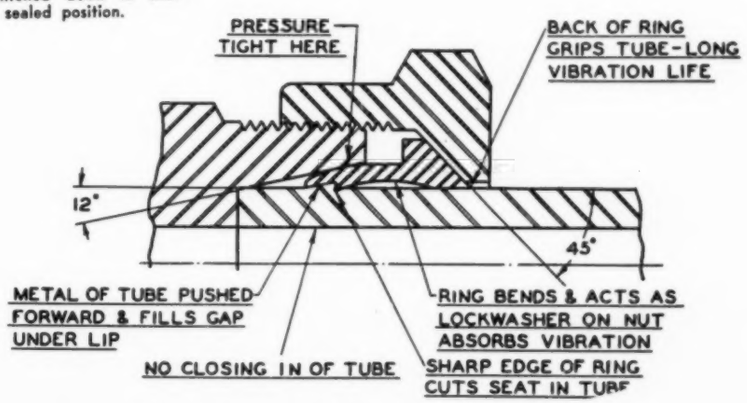
All of the above advantages add up to dollars saved in installation and maintenance costs, because one the Ermeto fitting is properly installed, it will not blow off the tube or break down. Manufacturers' figuring costs of making necessary tubing joints can cut their production cost by using Ermeto fittings, which eliminate flaring, save welding, and soldering material.

The high labor cost factor is solved by the elimination of the threading operation which consumes valuable time. Costly threading dies, which ordinarily wear out rapidly in use, are saved.

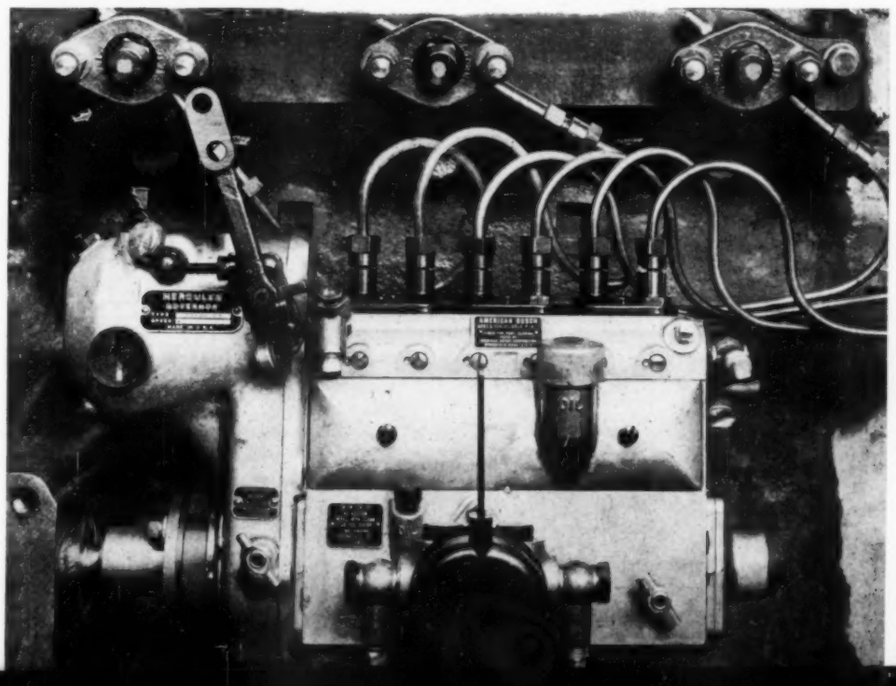
Diesel engineers are familiar with the difficulty mechanics experience while preparing high pressure injection lines by upsetting prior to installation. The Weatherhead Ermeto fitting does away with upsetting the ends of injection tubes. Longer life of the tubes is obtained under severe vibration conditions. Standard injection nozzles can be reseated with the Ermeto seat. Already manufacturers are providing Diesel injection equipment with Ermeto seats in the nozzles. Subsequent uncoupling and reassembly can thus be easily accomplished.




(1) as it goes together; (2) as tightened down in final sealed position.


PRESSURE TIGHT HERE
BACK OF RING GRIPS TUBE-LONG VIBRATION LIFE
12°
45°
METAL OF TUBE PUSHED FORWARD & FILLS GAP UNDER LIP
RING BENDS & ACTS AS LOCKWASHER ON NUT ABSORBS VIBRATION
NO CLOSING IN OF TUBE
SHARP EDGE OF RING CUTS SEAT IN TUBE

Diesel injection system equipped with Ermeto fittings.



# RECORD FUEL ECONOMY WITH NEW GAS DIESEL

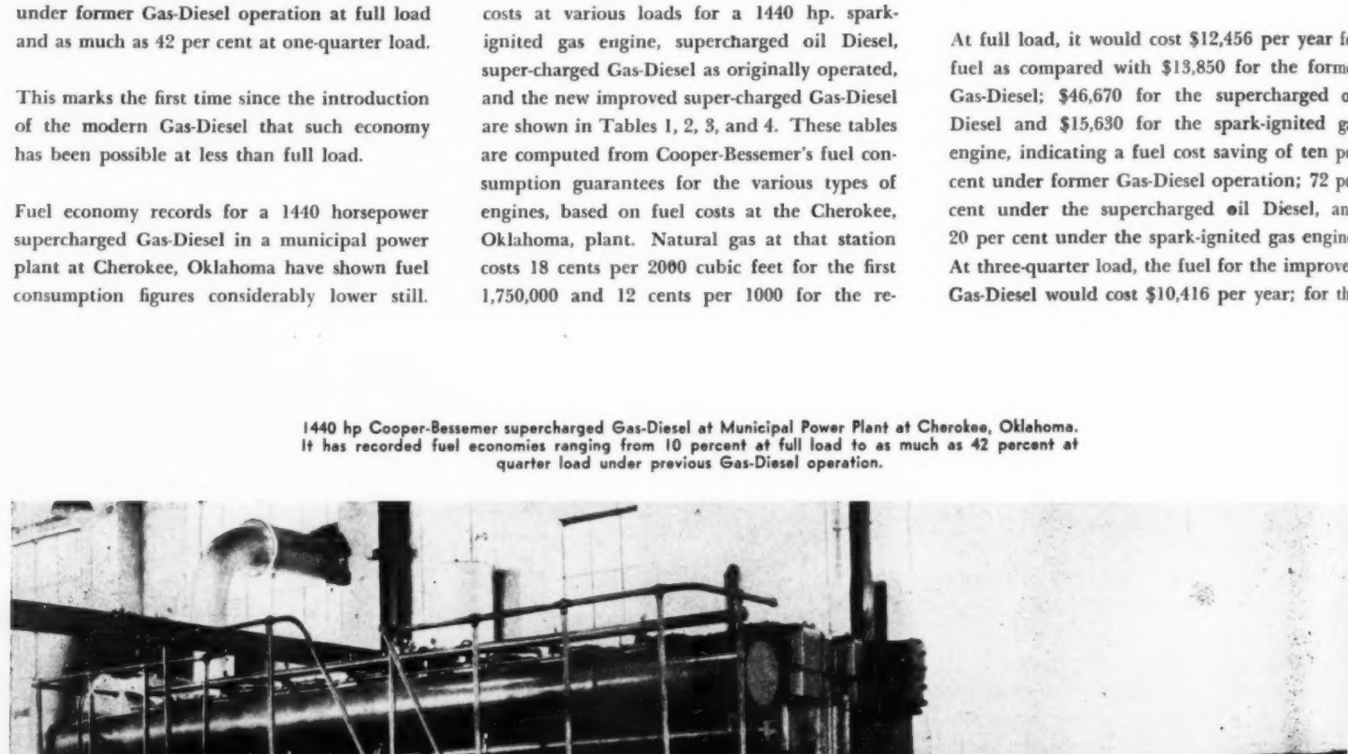
THE latest improvements achieved by The Cooper-Bessemer Corporation's engineering department in connection with its Gas-Diesel engine are reducing fuel costs by 10 per cent under former Gas-Diesel operation at full load and as much as 42 per cent at one-quarter load.

This marks the first time since the introduction of the modern Gas-Diesel that such economy has been possible at less than full load.

Fuel economy records for a 1440 horsepower supercharged Gas-Diesel in a municipal power plant at Cherokee, Oklahoma have shown fuel consumption figures considerably lower still. This unit, which was the first of the new type to be delivered, is an 8 cylinder Type LS, and has been in continuous service since March of this year. A complete set of tables showing fuel costs at various loads for a 1440 hp. spark-ignited gas engine, supercharged oil Diesel, super-charged Gas-Diesel as originally operated, and the new improved super-charged Gas-Diesel are shown in Tables 1, 2, 3, and 4. These tables are computed from Cooper-Bessemer's fuel consumption guarantees for the various types of engines, based on fuel costs at the Cherokee, Oklahoma, plant. Natural gas at that station costs 18 cents per 2000 cubic feet for the first 1,750,000 and 12 cents per 1000 for the remainder each month, while Diesel fuel oil is seven cents per gallon. These figures show the following fuel cost reduction for the improved Gas-Diesel:

At full load, it would cost $12,456 per year for fuel as compared with $13,850 for the former Gas-Diesel; $46,670 for the supercharged oil Diesel and $15,630 for the spark-ignited gas engine, indicating a fuel cost saving of ten per cent under former Gas-Diesel operation; 72 per cent under the supercharged oil Diesel, and 20 per cent under the spark-ignited gas engine. At three-quarter load, the fuel for the improved Gas-Diesel would cost $10,416 per year; for the

1440 hp Cooper-Bessemer supercharged Gas-Diesel at Municipal Power Plant at Cherokee, Oklahoma. It has recorded fuel economies ranging from 10 percent at full load to as much as 42 percent at quarter load under previous Gas-Diesel operation.



former Gas-Diesel $12,700; the supercharged oil Diesel $34,540 and the spark ignited gas engine $12,740. Thus at three-quarter load the indicated fuel savings are 17 per cent under the former Gas-Diesel; 69 per cent under the oil Diesel, and 10 per cent under the spark-ignited gas engine.

At one-half load the fuel costs would be $8,326 per year for the improved Gas-Diesel; $12,024 for the former Gas-Diesel; $24,570 for the supercharged oil Diesel, and $10,340 for the spark-ignited gas engine, indicating fuel savings of 30 per cent, 66 per cent, and 19 per cent respectively.

At one-quarter load the comparative fuel costs are $6,144 per year for the improved Gas-Diesel; $10,690 for the former Gas-Diesel; $14,290 for the supercharged oil Diesel, and $7,990 for the spark-ignited gas engine. The indicated fuel savings are 42 per cent, 57 per cent, and 23 per cent respectively.

In commenting on these new developments, Ralph L. Boyer, vice president and chief engineer of Cooper-Bessemer, points out that ever since the development of the Gas-Diesel for modern use was announced, it has been a very economical power unit at full load. In fact, it was more efficient than any other type of prime mover, including the Diesel oil engine which is its closest competitor.

Manufacturers and users found, however, that as the load was decreased below the full load point, its efficiency decreased rather rapidly. At slightly under full load it would become less economical than the Diesel oil engine, and at anything from one-half load to one-third load, it would become less efficient than even the spark-ignited gas engine.

For this reason, engine builders have hesitated to recommend the Gas-Diesel for applications where the load factor was extremely variable. This situation would apply in the usual generating station, since their average load is very often light in spite of the fact that they are required to pull full load or an overload at frequent intervals.

"During the extensive research which Cooper-Bessemer engineers have conducted to solve this problem, results attained have by far exceeded our expectations," Mr. Boyer said.

"We found," he continued, "that the reason the Gas-Diesel was uneconomical at light loads was due to the leanness of the mixture. The lighter load made it more difficult to burn the charge with a pilot injection of fuel oil and the result was that a good percentage of the gas at light load was allowed to go up the exhaust stack without being burned.

"We have succeeded in finding a way of reaching that gas and burning it, so we can now state definitely that our present Gas-Diesels will show a lower Btu. consumption at any and all loads than that of the oil Diesel.

"Taking one-quarter load as an example, the oil Diesel will develop a brake horsepower hour for about 9,250 Btu's. The spark-ignited gas engine for this same percentage of load consumes 17,800 Btu's. The supercharged Gas-Diesel at one-quarter load has consumed 20,500 Btu's. The new supercharged Gas-Diesel at this same percentage of load will develop a brake horsepower hour for 8,950 Btu's. Similar reductions in fuel consumption have been effected on the atmospheric engines, also."

The Type LS 8-cylinder supercharged Gas-Diesel at Cherokee is rated 1440 brake horsepower at 300 rpm., and direct drives a 1000 kw. General Electric generator. Light load operation is extremely important because the engine runs at less than full load 75 per cent of the time. The operation of a number of grain elevators and alfalfa mills in Cherokee's area of coverage will probably necessitate the operation of the Cooper-Bessemer unit 24 hours a day during the summer months and approximately 18 hours a day during the winter months. During the winter months, from midnight until morning, smaller generating units in the plant will probably be used.

On the basis of the Cherokee installation and similar units tested in the plant, Mr. Boyer believes that this important Gas-Diesel improvement will open up many new fields of application for this type of power. This will be true not only in power plants, but in industrial and sewage plants in sections of the country where cheap gas is available and where facilities guarantee an adequate supply of this fuel.

TABLE NO. 1
SPARK-IGNITED GAS ENGINE FUEL COST

| Spark-Ignited Gas (a) | LOAD | | | |
|---|---|---|---|---|
| | 100% | 75% | 50% | 25% |
| Btu./Bhp./Hr. | 9500 | 10100 | 12000 | 17800 |
| Cu. ft./Mo x 1/1000 | 9980 | 7970 | 6310 | 4675 |
| Cu. Ft. at 18c x 1/1000 | 1750 | 1750 | 1750 | 1750 |
| Remainder x 1/1000 | 8230 | 6220 | 4560 | 2925 |
| Cost 1750 M at 18c | $315 | $315 | $315 | $315 |
| Cost Remainder at 12c | $988 | $747 | $547 | $351 |
| Total Cost/Mo. | $1303 | $1062 | $862 | $666 |
| Total Cost/Yr. | $15630 | $12740 | $10340 | $7990 |

TABLE 2
DIESEL ENGINE FUEL COST

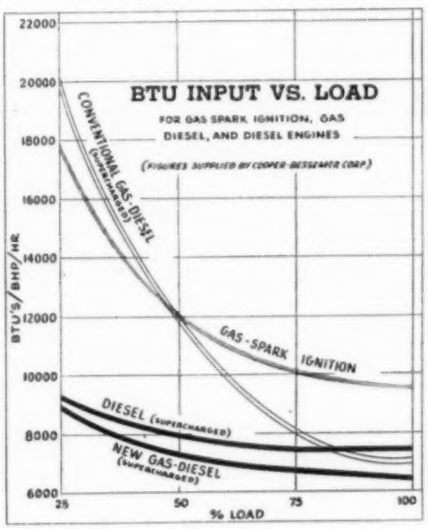
| Diesel (b) | LOAD | | | |
|---|---|---|---|---|
| | 100% | 75% | 50% | 25% |
| Btu./Bhp./Hr. | 7400 | 7450 | 7950 | 9250 |
| Gal. Fuel Oil/Yr. | 652500 | 493500 | 351000 | 204200 |
| Cost/Yr. at 7c | $45670 | $34540 | $24570 | $14290 |

TABLE 3
ORIGINAL GAS-DIESEL FUEL COST

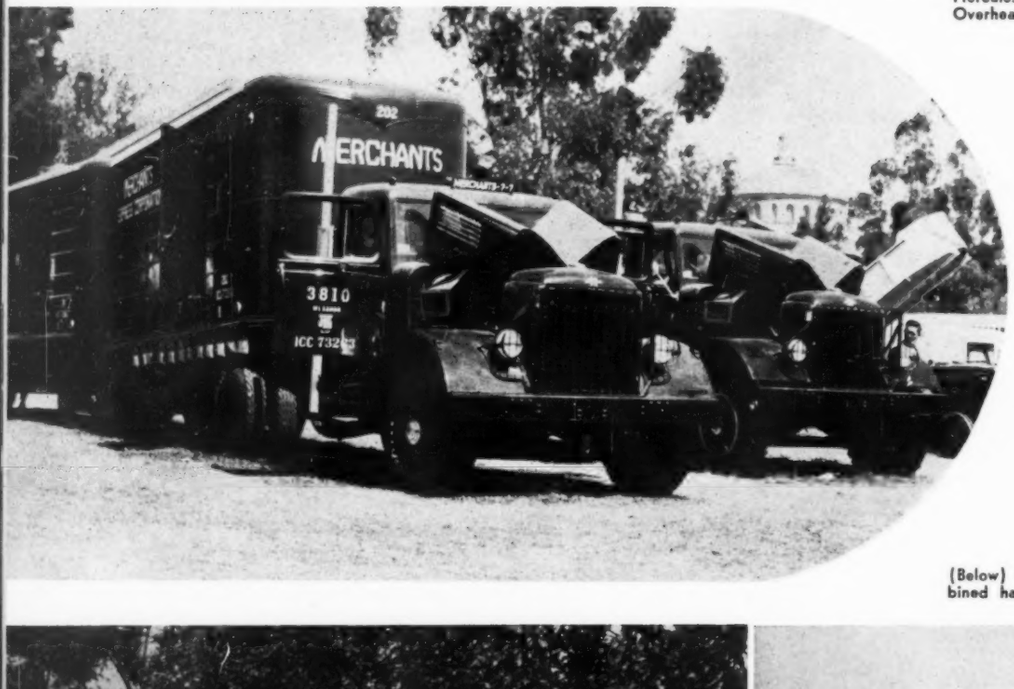
| Gas-Diesel —Original (c) | LOAD | | | |
|---|---|---|---|---|
| | 100% | 75% | 50% | 25% |
| Btu./Bhp./Hr., Total | 7200 | 8600 | 12000 | 20500 |
| Btu./Bhp./Hr., Gas | 6840 | 8120 | 11280 | 19060 |
| Cu. Ft./Mo. x 1/1000 | 7190 | 6400 | 5930 | 5010 |
| Cu. Ft. at 18c x/1000 | 1750 | 1750 | 1750 | 1750 |
| Remainder x 1/1000 | 5440 | 4650 | 4180 | 3260 |
| Cost 1750 M at 18c | $315 | $315 | $315 | $315 |
| Cost Remainder at 12c | $653 | $558 | $502 | $391 |
| Cost Gas/Mo | $968 | $873 | $817 | $706 |
| Btu./Bhp./Hr. Oil | 360 | 480 | 720 | 1440 |
| Gal. Oil/Mo. | 2650 | 2650 | 2650 | 2650 |
| Cost, Oil/Mo. at 7c | $185 | $185 | $185 | $185 |
| Total Cost, Gas & Oil/Mo. | $1153 | $1058 | $1002 | $891 |
| Total Cost, Gas & Oil/Yr. | $13850 | $12700 | $12024 | $10690 |

TABLE 4
NEW GAS-DIESEL FUEL COST

| Gas-Diesel —Present (d) | LOAD | | | |
|---|---|---|---|---|
| | 100% | 75% | 50% | 25% |
| Btu./Bhp./Hr., Total | 6400 | 6750 | 7350 | 8950 |
| Btu./Bhp./Hr., Gas | 6080 | 6323 | 6710 | 7670 |
| Cu. Ft./Mo. x 1/1000 | 6400 | 4980 | 3530 | 2015 |
| Cu. Ft. at 18c x 1/1000 | 1750 | 1750 | 1750 | 1750 |
| Remainder x 1/1000 | 4650 | 3230 | 1780 | 265 |
| Cost 1750 M at 18c | $315 | $315 | $315 | $315 |
| Cost Remainder at 12c | $558 | $388 | $213 | $32 |
| Cost Gas/Mo. | $873 | $703 | $528 | $347 |
| Btu./Bhp./Hr., Oil | 320 | 427 | 640 | 1280 |
| Gal. Oil/Mo. | 2355 | 2355 | 2355 | 2355 |
| Cost Oil/Mo. at 7c | $165 | $165 | $165 | $165 |
| Total Cost, Gas & Oil/Mo. | $1038 | $868 | $693 | $512 |
| Total Cost, Gas & Oil/Yr. | $12456 | $10416 | $8326 | $6144 |



Hercules powered Cletrac line at State Fair represented by Sargent Overhead bucket rig (foreground), Drott bulldozer (left) and large logging tractor (far left)

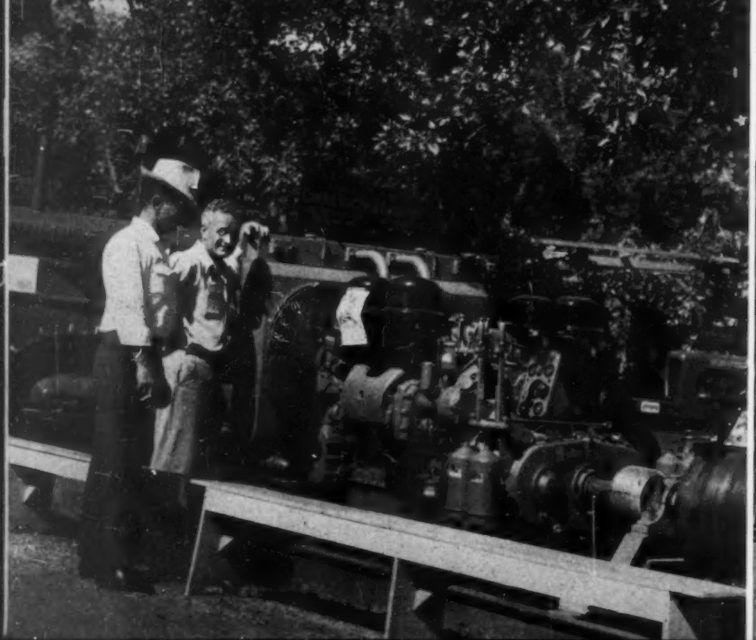


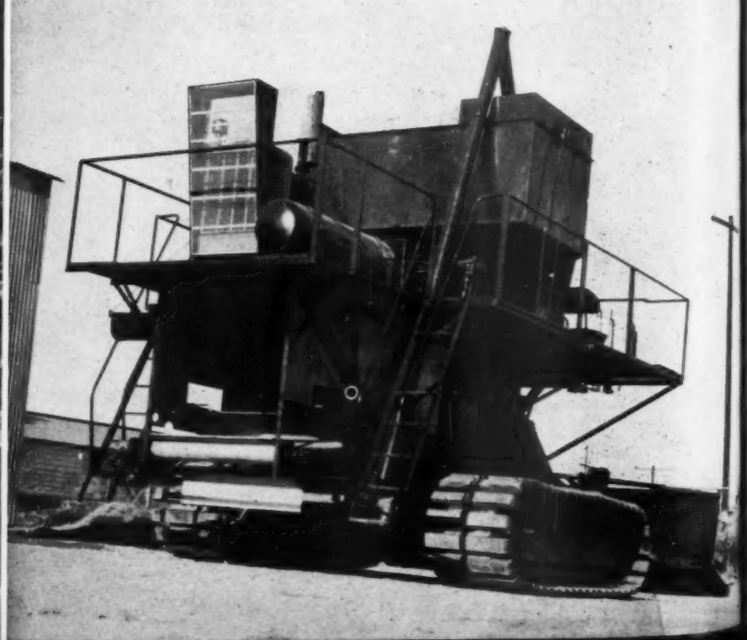

(Above, left) Caterpillar exhibit included Diesel tractor with Hyster winch (left), as well as several other tractor models.

Heavy duty truck trailer combinations such as these two International jobs were on exhibit. Cummins and International Diesels power these freighters.

(Below, left) Allis-Chalmers exhibit with General Motors twin Diesel unit (foreground). Allis-Chalmers tractor at left.

(Below) State Fair visitors viewed this General Motors engined combined harvester built by the Capital Machine and Welding Works.





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# DIESELS DOMINATE CALIFORNIA STATE FAIR

*By* F. HAL HIGGINS

AGRICULTURE wants Diesels in more jobs for its post-war future and the manufacturers and dealers are going to give them what they want. That is the writer's conclusion after a visit to the first post-war California State Fair. This was the first such agricultural show in this state since 1941. Hence, it was worthy of study and the lessons were there with the answers very easy to read. Your Old Reporter has been visiting this California State Fair regularly since 1928, missing only four while in the Mid-West from 1930 to 1933. He saw Allis-Chalmers show the first U. S.-built Diesel tractor ever exhibited when an Atlas Diesel was set into an A-C chassis and sent to the 1928 event. Also, he has been visiting State Fairs regularly from the Atlantic to the Pacific for some thirty years.

From the farm machinery standpoint this 1947 California fair sets a new high mark in mechanized agriculture. This machine show never had a more eager audience than was seen at this fair. For one thing, the farmer is still not getting much new machinery. He has been patching old and obsolete tools and machines until he is fed up with old stuff. Also, three-billion-dollar industries with plenty of vision and well financed research staffs have moved into the farm field in the red hot competition for the farmer's favor as they concentrate on fertilizers, insecticides and weed killing. Hence, the tools and implements that apply fertilizers to the land, swat the bugs that pester live stock and crops, and battle weeds that cut down quality and quantity of farm products have been advancing with a speed never before encountered in the farm machinery industry.

Tractors dominated the fair exhibits, of course, and the crawler tractors with Diesel engines for power were the big show in spite of many new garden tractors. International and Caterpillar with their own Diesel engines had their usual big showing. By letting local dealers in the area put on the show for the manufacturers, Oliver with its Cletrac crawlers powered by Hercules had its best show ever. For the growing industrial demands, Cletrac showed a Sargent overhead front-end bucket scoop on one tractor, a Drott bulldozer on another, and its logging special in the biggest sizes. It was Hercules Diesel's greatest show at a western state fair and seems to augur a future for this old engine builder as Oliver starts rolling with its first complete dealer coverage in California. Heretofore, Oliver and Cletrac dealers were ccattered and weak and got what business was left after the big strong dealers with both wheel and track lines had skimmed the cream until war shortages forced every farmer, logger and dirt mover to shop around and take any tractor he could get. Now the new Oliver-Cletrac set-up has its dealer organization covering the territory like a blanket while western agriculture proceeds to move as the most highly efficient farming system in the world and a population shift aids its marketing by largely increasing home consumption. Economically, war has given the West, especially California, a big advance in population with high pay from increasing industrial jobs.

Allis-Chalmers tractors were powered with GM Diesels for their big sizes. With their Sacramento and Stockton dealers also handling GM engines for pumping, mill work and other stationary and portable jobs, the A-C exhibit was nicely balanced and attracted a lot of interest from mine, logging, contracting and farming interests. Allis-Chalmers dealers in central California and Nevada have done a fine business in GM Diesels the past few years and have led the country in sales to farmers for use in powering their own machines such as combined harvesters built on their ranches by their skilled labor. In this connection such a GM Diesel-powered combined harvester just now under construction at the Capital Machine Works in North Sacramento, only two or three miles from the fair grounds, attracted many State Fair visitors who have watched this trend to machine building in small shops and on ranches to meet the demands of big rice and grain ranchers. These have been costing the farmers around $25,000 this year, some half dozen being built in two shops at Stockton and Sacramento. All are powered by GM Diesels in pairs from the Allis-Chalmers' dealer floors. The big lumber shortgae, too, has put the emphasis on Diesels in the saw mills as well as in trucks and tractors, until this field has become very important to those dealers in the logging areas.

Caterpillar Tractor Co. made its show through its local dealer, Weaver Tractor Co. Caterpillar made its appeal to logger and contractor as well as to farmer in showing Traxcavator front-lift scoops, Hyster dragline mounted on their Diesel tractor, and Athey overhead scoop. The Caterpillar stationary Diesel was also shown in electric set. D2, D4 and D6 size Cat Diesels as well as the popular D8800 stationary engine and smaller electric unit were in evidence on their stand.

Cummins Diesels were seen in one of the two big International trucks parked on the lot at the north side of the machinery building. The other rtuck was powered by International's newest Diesel, specially designed for heavy trucking on big contracting jobs.

Fairbanks, Morse had a fine pump exhibit with all types of pumps except the big turbines, which remained out of the show this year on agreement among the manufacturers. The handy little 45B model 5½ hp. F-M Diesel was the power on one pump to catch the eye. There is going to be a lot more competition and a widening of this field of small Diesels soon with the filling up of dealers' floors and a growing demand from farmers, loggers and contractors for all-Diesel equipment on a job, say students of the trends.

# Crankshaft Repair for Tug MAPLE LEAF

THE Diesel tug *Maple Leaf* had just passed Cornwall on the Hudson on her way to Albany. Twelve hours previous she had left her slip at Bayonne for the long haul to Buffalo to pick up loaded barges. Everything was going smoothly just as always when suddenly a heavy knock developed in her main engine. The engineer immediately shut down the engine to investigate the cause. The crankcase cover plates were removed and the bearings checked and it was discovered that the crankshaft had broken through the after web of the No. 5 crank.

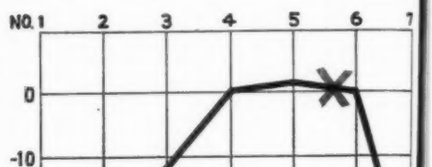
The *Maple Leaf* was taken in tow and brought to New York for repairs. The owners of the tug *Maple Leaf*, the Conners Marine Co. of New York after considering the cost of replacing the broken shaft and the time involved in obtaining a new shaft called in a recognized repair outfit, Metalock Casting and Repair Service to examine the shaft and see if it was salvageable.

The engine of the *Maple Leaf* is a 6 cylinder 350 hp. Diesel. The crankshaft is of the balanced type, 8 inches in diameter and approximately 16 feet long, with the flywheel mounted on the aft end of the shaft and fitted directly to the intermediate shaft coupling. The material of the shaft is of good quality forged steel conforming to the specifications for SAE-1045 steel with an ultimate strength of approximately 80,000 psi. and a yield strength of 50,000 psi. The physical characteristics of the fracture indicated progressive failure starting in the crank pin fillet and progressing in a semicircular path through the web to a point about 4 inches above the forward fillet of No. 6 journal. A preliminary investigation was made to determine the feasiibilty of making a repair which included a careful inspection for incipient fractures in the fillets of all journals and crank pins. The bearing surfaces were inspected for serious scores and other damage which might have made a repair inadvisable. Also the shaft was checked for permanent set which would affect repair effectiveness. The checking of the shaft alignment, one of the most interesting of the operations, involved some ingenious methods.

All the connecting rods were disconnected and suspended free of the shaft by blocking pistons. All bearing caps were removed and all interfering brackets, piping, etc., were disconnected. No. 5 and No. 6 cylinders were removed to make headroom over the broken section of the shaft.

The first step in checking the alignment of the bearings was to install "tangents" to support a 0.016 inch diameter steel wire. The "tangents" consisted of brackets with micrometer adjustment for lateral and vertical movement. Grooved pulleys were mounted on precision bearings supported by the adjustable "tangents." The wire was then stretched to produce a stress of about 150,000 psi. The tangents were adjusted to bring the wire directly over a scribed center line on each journal and reference measurements were taken from the end journals to the wire. All other journals were checked by measuring to the wire and the micrometer readings were corrected to compensate for the wire sag at each journal. Compensation was also made for the deflection of the shaft required to seat the journal in the bearing and for variation of journal diameters from the nominal diameter. This check was repeated with the shaft rotated 180°. The data obtained showed the exact vertical alignment of the bearings and the position in which the shaft had been operated prior to the failure.

The diagram below illustrates the position of




the main bearings as found by the above method. A similar procedure was employed to check the vertical alignment of the base section of the crankcase. The wire in this case was mounted above the side rails of the base section and micrometer measurements were taken from the machined top surface of the rails to the wire. By this check the frame appeared to be high in the center by about 8 mils.

A bridge gauge was built and a set of readings were taken for future use. These data confirmed the misaligned condition determined by the tight wire method and since only 8 mils of deflection of the frame was found, the major contributing factor in the misalignment of the shaft was presumed to be caused by the improper fit of the main bearing shells.

The next step in the investigation was to check the thickness of the lower bearing shells. This was done by taking an average of measurements at three points on each end of the shells. The shell thicknesses as found were as tabulated below.

Original Shell Thickness

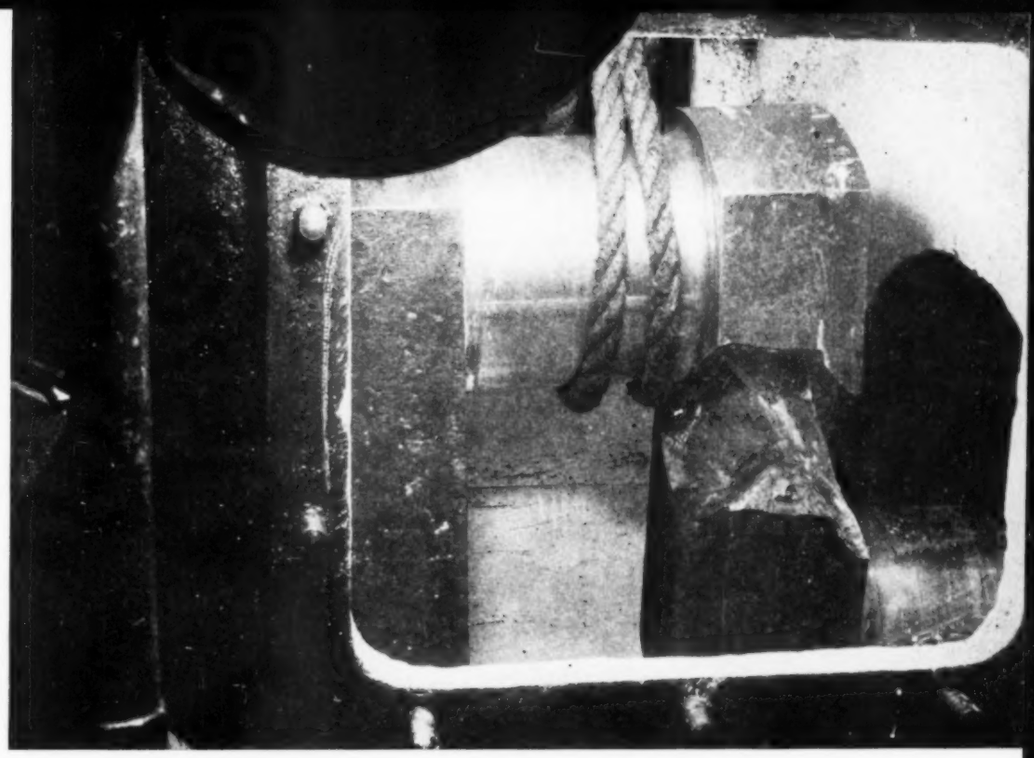
| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Shell Thickness | 1.721 | 1.722 | 1.737 | 1.740 |

| 5 | 6 | 7 |
|---|---|---|
| 1.740 | 1.741 | 1.701 |

The error introduced by the 8 mil warp of the main frame plus variations in journal diameters accounted for the difference between the data above and that shown in the drawing.

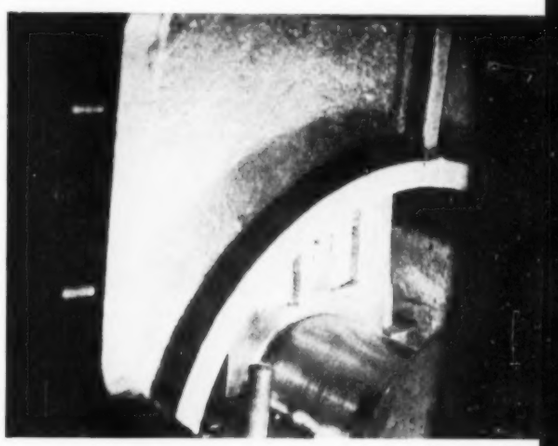
Bearings No. 4, 5 and 6 were installed again for temporary use while aligning the shaft. However when an attempt was made to raise No. 7 journal to alignment with journals 4, 5, and 6 the shaft was fouled in the thrust housing so that it could not be raised. It was then necessary to disassemble the thrust bearing and check for further errors. The radial bearing of the thrust assembly was found to be sufficiently low to restrict the after end of the shaft from being aligned. This condition had presumably caused the number 7 bearing to fail completely. The after end of the shaft was then centered in the thrust housing. With the shaft held true in this position a temporary bearing was installed in the No. 7 position and number 1, 2, and 3 bearings were replaced with temporary bearings of the proper shell thickness.

Some difficulty was experienced in designing a strongback of sufficient strength and also with sufficient flexibility to permit close adjustments of alignment. The strongback had to be designed to permit free rotation of the shaft and to allow access for a major part of the repair to be completed before it was removed. After experimentation a successful strongback was designed which could be drawn tight with straight compressive load of over 350,000 lbs. without causing objectional lateral strain. After experimentation a successful strongback was designed which could be drawn tight with a straight compressive load of over 350,000 lbs. without causing objectional lateral strain. After setting the strongback the repair was begun. Slots in the fillet and the after side of the web were prepared by drilling a line of holes on accurately spaced centers. The thin web of metal between the holes was removed leaving a slot with a series of indentures to receive the preformed Metalock bar. Eight of these bars were required to fill each of the two inch deep slots. The slots on the after side of the web were spaced so as to be offset one half space from those on the forward side. The Metalock sets were spaced on approximately one inch centers depending upon the character of the fracture. Over these locks were set two ¾ in. x 2 in. x 6 in. stainless steel plates or Masterlocks. The function of these Masterlocks is to provide additional strength over that provided by the use of Metalocks alone and to distribute stress over a wider area. For the crankshaft repair the Masterlocks were cut from type 302 stainless steel and were machined with a series of half holes around the perimeter matching similar holes drilled in the forging itself. The Masterlocks are designed for a slight dovetail fit and are anchored in place by alloy steel pins driven in and upset into the matching half holes between the lock and the parent metal. The sides of the webs were also Masterlocked.



Photograph of "Mapleleaf's" crank shaft before Metalock repair was begun. After web of NO. 5 crank is completely fractured. Alignment main bearings and crankshaft was accomplished before repair was started.

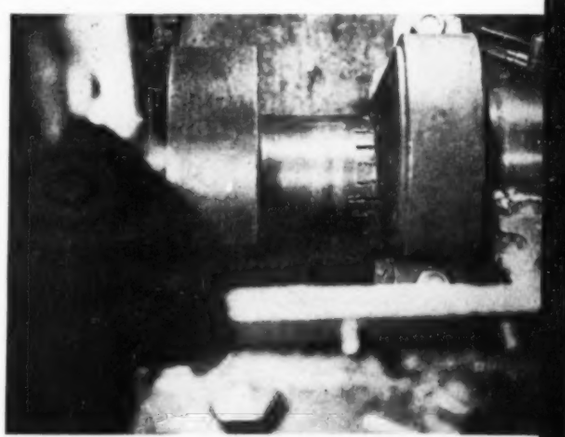
Photograph below shows crank web ready to receive Masterlocks stainless steel blocks ¾"x2x6 inches in dimension. These are set over Metalocks.



Metalacing, a technique of dowling and studding was used in the line of fracture between the Metalocks and Masterlocks to provide tortional resistance in the repair. This process also serves to preload the Metalocks in tension thus making them highly resistant to fatigue failure.

Constant checking of the alignment was carried on during the entire procedure of repair. A final check of the alignment with the tight wire and bridge gauge showed the bearings to be within one to two thousandths of an inch of proper vertical adjustment. Lateral alignment and vertical alignment were again checked by measuring web distortion. With all main bearing shims removed and the bearing caps drawn snug to permit no slack, the maximum distortion found on any crank was less than one thousandth of an inch. Crank distortion up to .005 inch would ordinarily be tolerated. Parallelism of the web faces was maintained to .001 in. and the web lengths checked to .001 in. Considering the fact that the *Maple Leaf's* Diesel had been operating for 17 long years, and that wear had taken place. The crankshaft nevertheless was repaired within the tolerances allowed for a new crankshaft.

Method of installing Metalocks: holes drilled in series on one inch centers, metal removed between holes permitting installation of Metalock bar in parent metal to depth of 2 inches thus locking metal fracture.



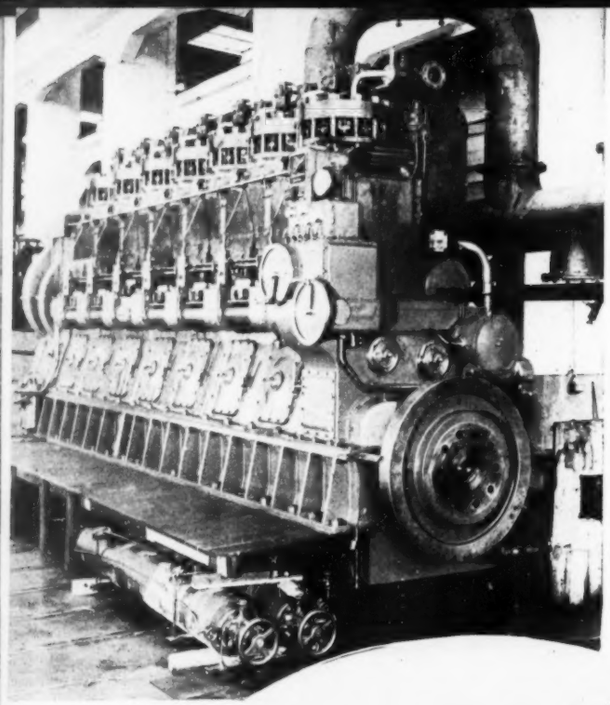
After a suitable breaking in period the tug was

. . . . *And now please turn to page 80* . . . .

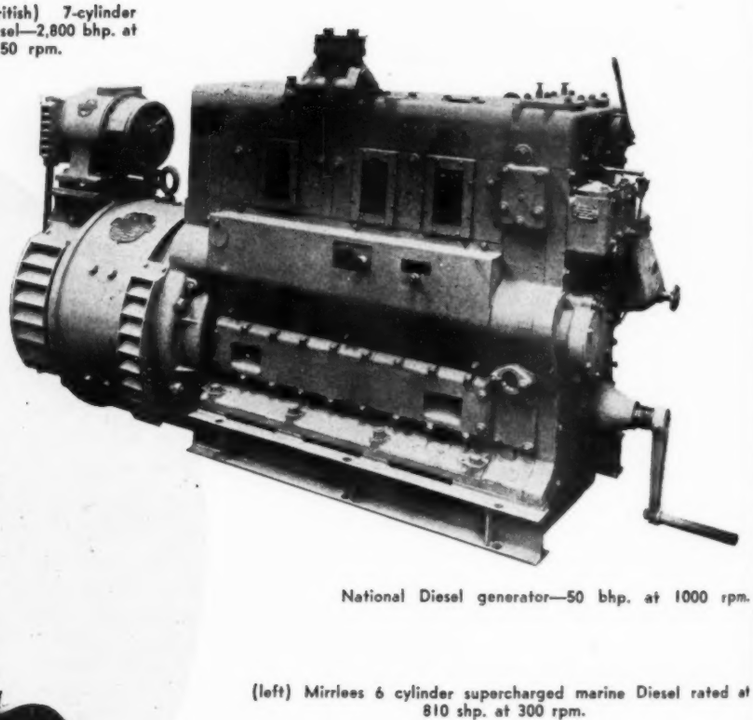
# DIESEL PROGRESS IN

## Diesels Featured at the Olympia Engineering and Marine Exhibition

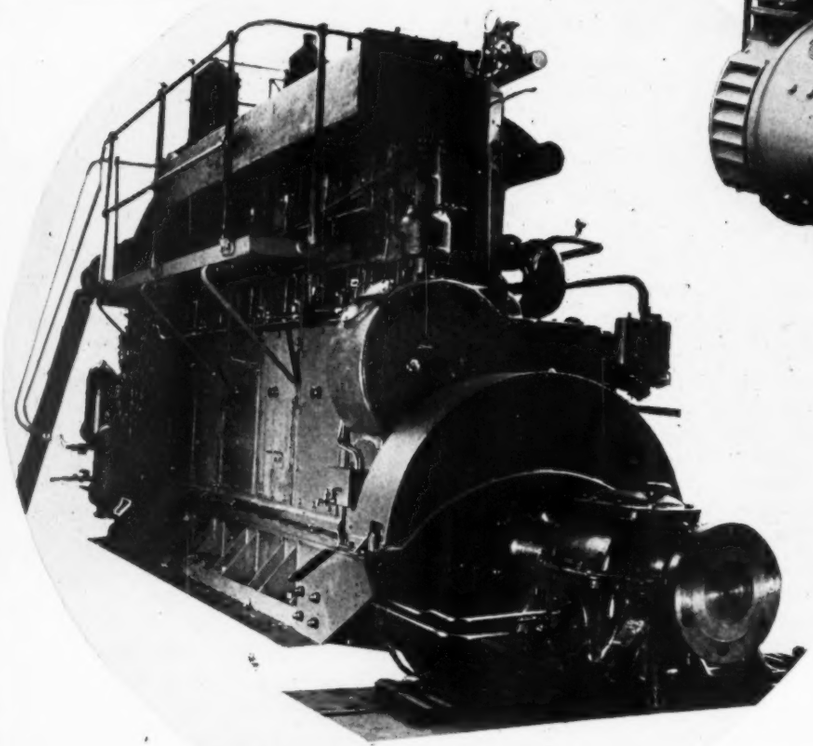
*By* HAMISH FERGUSON



Atlas (British) 7-cylinder marine Diesel—2,800 bhp. at 250 rpm.



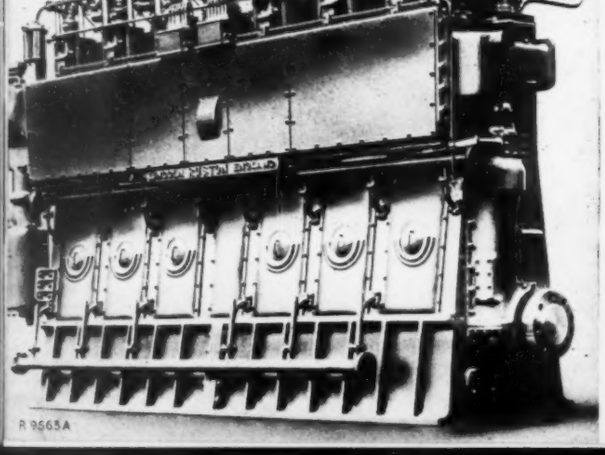
National Diesel generator—50 bhp. at 1000 rpm.

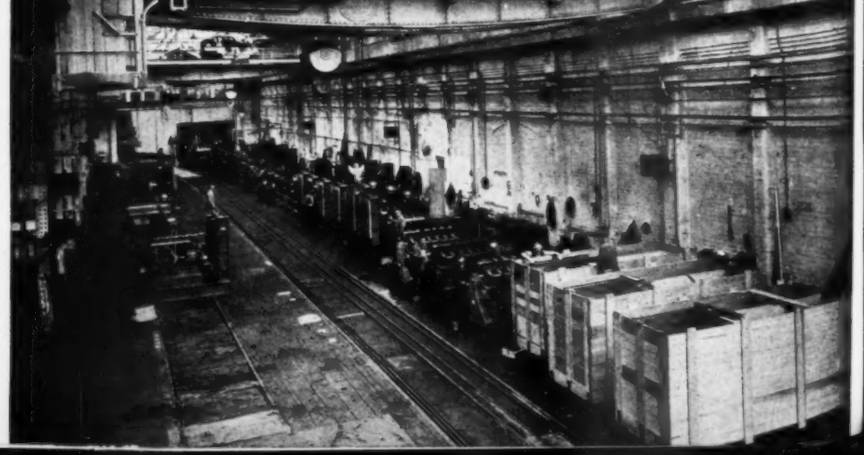


(left) Mirrlees 6 cylinder supercharged marine Diesel rated at 810 shp. at 300 rpm.

(Below left) Ruston marine Diesel—1,610 bhp. at 435 rpm.

View of McLaren plant, group of engines being prepared for shipment to india.





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# IN GREAT BRITAIN . . . PART IV

THE Engineering and Marine Exhibition, which also incorporates the Foundry Trades Exhibition and the Welding Exhibition, made its first reappearance since the War and was held at Olympia, London, recently.

The exhibition was well supported by the Diesel industry and all the leading manufacturers displayed examples of their latest designs up to the sizes which are practicable from the transport and handling point of view. Many of the engines incorporate improvements on earlier successful designs and in addition there are several types which are quite new in the Diesel field.

The manufacture of McLaren engines is now controlled by Associated British Oil Engines Ltd. and the fundamental design of their standard "M.R." type engine remains unchanged. The four-cylinder "M.R." model is one of those selected for priority manufacture under the Government sponsored plan to provide a large quantity of small generating sets to produce additional electric power for the factories. The McLaren "M.R." series is built in six cylinder sizes rated at 33 bhp. at 750 rpm. for the 2 cylinder model up to 176 bhp. at 1,000 rpm. for the 8 cylinder engine.

The well-known engine builders, Mirrlees, Bickerton & Day Ltd. are also controlled by Associated British Oil Engines Ltd. and the Mirrlees series of engines covers a range of output from 135 bhp. to 1,400 bhp. Due to the persistent demand for higher powers in engines at medium rotational speeds, Mirrlees have catered for this by producing their "TV" engine which is a V-type developed from the earlier "TL" vertical engine. The cylinder banks are mounted on a new form of crankcase, the cylinders being set at an included angle of 35°. This unusually small angle results in a very compact engine, the overall width being little more than the width of the bedplate.

The engine exhibited has 12 cylinders, 8½ in. bore x 13¾ in. stroke and develops 720 bhp. when normally aspirated and 1,050 bhp. when exhaust turbo-charged. The maximum speed is 750 rpm. The fuel consumption of the pressure-charged engine is given as 0.37 lb./bhph. at full rated load.

The outstanding exhibit of the National Gas and Oil Engine Co. was their new "M4AM6" type 5 cylinder marine propulsion unit provided with an oil-operated reverse-reduction gear box manufactured by The National Co. The output of the engine is 200/220 bhp. at 1,200 rpm.

The engine is of advanced design having 4 valves per cylinder, operated by two camshafts. The cylinder head design is unorthodox in that the inlet valves and exhaust valves are situated on each side of the engine with their own inlet and outlet ports. With this arrangement of valves there is an alternate "inlet," "exhaust," "inlet," "exhaust" which promotes a swirl resulting in a high efficiency. A cast crankshaft is employed, the material being a special iron of the acicular type having an ultimate tensile strength of 30 ton/sq. in. The aluminum alloy pistons are of the pressed design giving a material equal to a forged piston, the section comprising a core with a cast surface. These pistons are pressed from a casting thus combining the benefits of a forged structure with a cast surface, the latter having been found to be the most suitable running surface.

Ruston & Hornsby Ltd. are exhibiting one of the largest engines they have yet built. It is the 6 cylinder model in their new "VOX" series and is capable of developing 1,610 bhp. at 435 rpm. This type of engine is constructed in sizes ranging from 5 to 9 cylinders so that the range of powers extends from 1,340 to 2,410 bhp.

The "VOX" engines are of the 4 cycle, totally enclosed, direct-injection type with exhaust turbo-charging. Bore and stroke are 17 in. x 18 in. and the rated bmep is 119.2 lb./sq. in. at 435 rpm. and a piston speed of 1,305 ft./min. Full load fuel consumption is given as 0.37 lb./bhph. the pistons have separate alloy heads and cast iron skirts and are oil cooled. The pressure-charger consists of a single stage centrifugal blower driven by the exhaust gas turbine and forms a compact unit which is located centrally on one side of the engine. The turbine rotor consists of a disc to which specially profiled blades of heat resisting steel are welded, the disc being mounted on a common shaft with the blower impeller.

In summing up the new features shown in the engines referred to, the following points are of interest.

*Rotational Speeds.* There is a general tendency for engine speeds to increase and notably 435 rpm. the designed speed for the new Ruston VOXM series, would have been considered unduly high for a 9 cylinder marine-type engines developing 2,410 bhp. only a few years ago.

The introduction of the oil-operated reverse-reduction gear box, or alternatively electric drive, has made these increases possible and has resulted in the saving of much cargo space and weight.

*Supercharging.* The system of turbo pressure-charging for the higher powered engines is becoming increasingly popular as is instanced by the Mirrlees and Ruston exhibits.

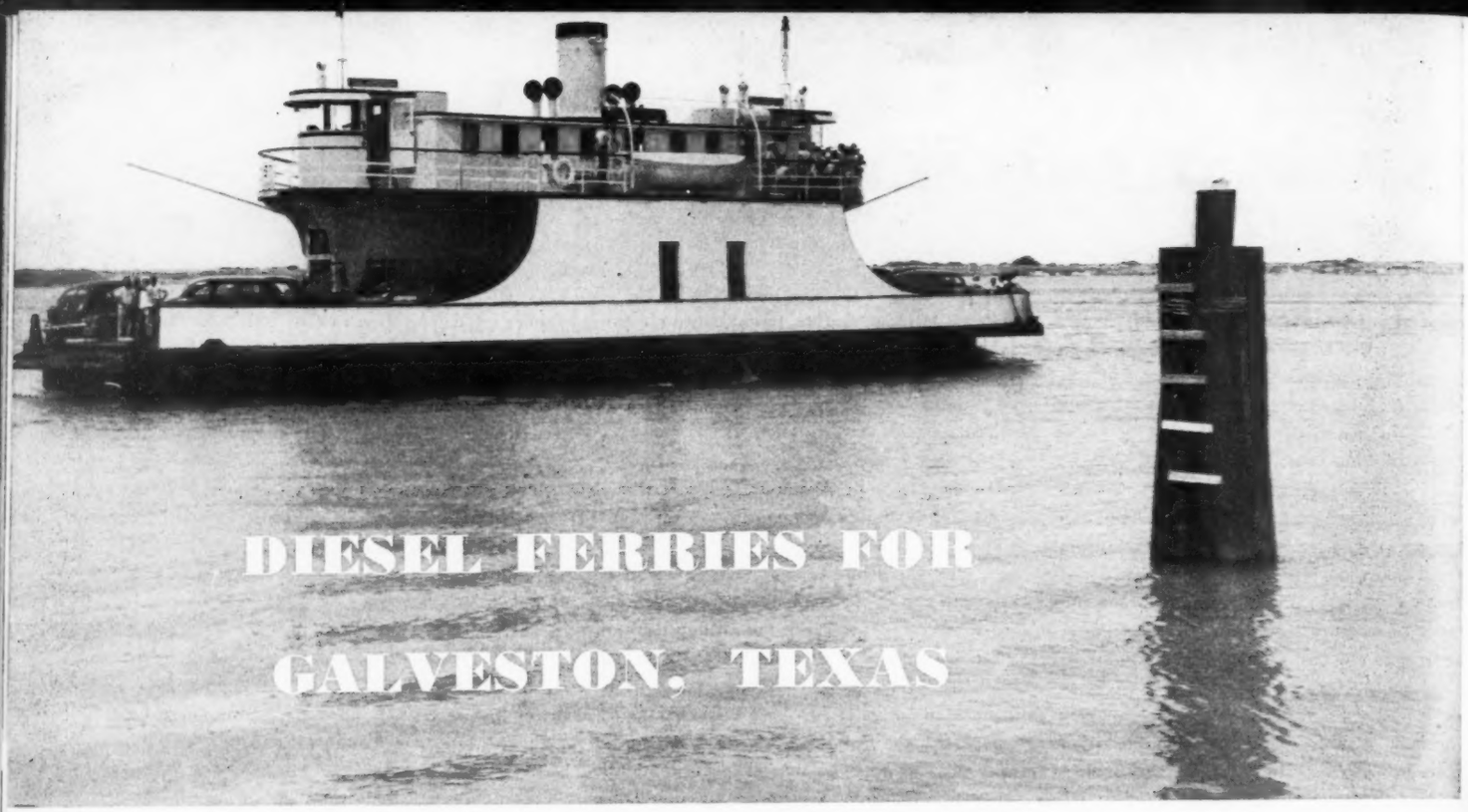
*Efficiency.* If fuel consumption can be accepted as the best measure of efficiency then progress is being made. The figure of 0.35 lb./bhph claimed by National for an engine operating at a normal speed of 1,250 rpm. is an outstanding performance.

*Valves.* The tendency towards employing 4 valves per cylinder on 4 cycle engines instead of the more usual two is increasing and both Mirrlees and National have adopted this design in their new types. Gas frictional losses are reduced with the 4-valve cylinder head and the National design with "alternate" inlet and exhaust is particularly ingenious.

*Crankshafts.* Cast crankshafts made from special irons and semi-steels have been in use for some time but it is interesting to note that National have standardized on a cast shaft for their new marine series and that this practice has the approval of Lloyds and all the other recognized authorities.

The engines described represent only a small proportion of the total on show and there is every indication that designs are being improved all the time and that efficiencies are being increased. Materials, also, show a marked advancement over those in common use prior to the intensive development of the gas turbine.

*Note:—The author wishes to point out that the illustrations used in his article published in the July issue of DIESEL PROGRESS were kindly supplied to him by courtesy of the "Oil Engine & Gas Turbine."*



# DIESEL FERRIES FOR GALVESTON, TEXAS

*By* WILL H. FULLERTON

GALVESTON, Texas, is a busy spot. Its waters are the business end of the ship channel to Houston, about fifty miles north; over a long bridge or viaduct, a wide highway carries the traffic to points north and west, but for vehicles going east, it's another story.

There is plenty of traffic eastward, for the route to Beaumont, as well as to Port Arthur, Orange and thence to Louisiana along Highway 90 leads east from Galveston; the highway runs along the surf-pounded beach for miles, but before you get to this scenic lane you must cross Galveston Bay and that means a ferry, for the cost of a bridge long enough to do the job is as yet prohibitive to Texas.

So here the State Highway Department operates a ferry system, crossing the sea lane where during the early days of the war it was no unusual sight to see dozens of tankers forming into convoys for protection against the submarine raiders then infesting the Gulf of Mexico. Gun positions around Galveston Bay were thicker than barnacles on a sunken wreck and a man even carrying a camera stood a swell chance of winding up in the jug or being popped by some trigger-happy recruit. Today, however, it is different. Highway 87 and its ferry continuation to Galveston welcome visitors and there is 24-hour service available for them.

According to A. B. Branch, chief marine engineer of the ferry system, the service uses two boats. One of these is the *Jefferson,* 117 ft. overall length, 31.2 ft. beam and with a 9.25 ft. depth of hold, of 185 net tons and 214 gross, powered with a Nelseco Diesel of 300 hp. The other is the *Galveston,* 106.5 ft. in length, 33.1 ft. beam, 11.2 ft. depth, and with a gross tonnage of 410.

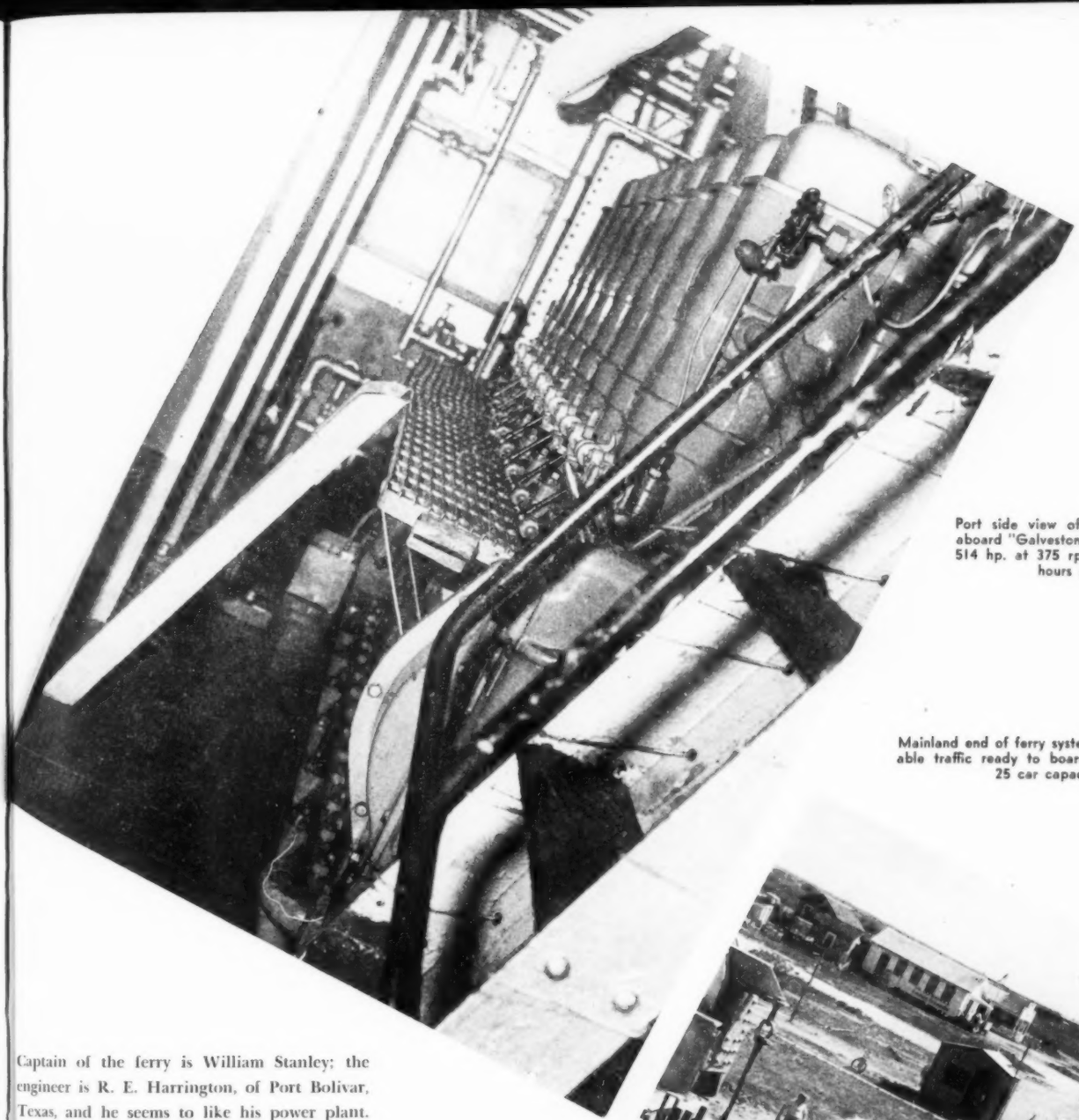
During the busy summer months both boats are on duty every day, one of them operating on a 24-hour schedule, the other working for 16 hours except for Saturdays, Sundays and holidays when it also goes on a 24-hour shift. This rigorous schedule is somewhat relaxed in the winter, but during the season of heavy travel there is no rest for the ferries. About twenty or twenty-five minutes is required for the trip from slip to slip and twenty-five autos are the usual freight as well as plenty of foot passengers.

The *Galveston* has a propulsion system which is unique. For fast loading, unloading and docking, the boat is a double-ender and is never turned around. She hasn't any bow or stern, as such; whichever way she is heading is the bow, and she has two pilot-houses, one on each end, with identical steering wheels and engine room signals. The captain uses the forward one, changing of course every trip. On the wall near each steering-wheel is a dial with two indicator positions; one of these says "North," the other "South." And down in the engine-room the other end of this control says "Forward" and "Reverse."

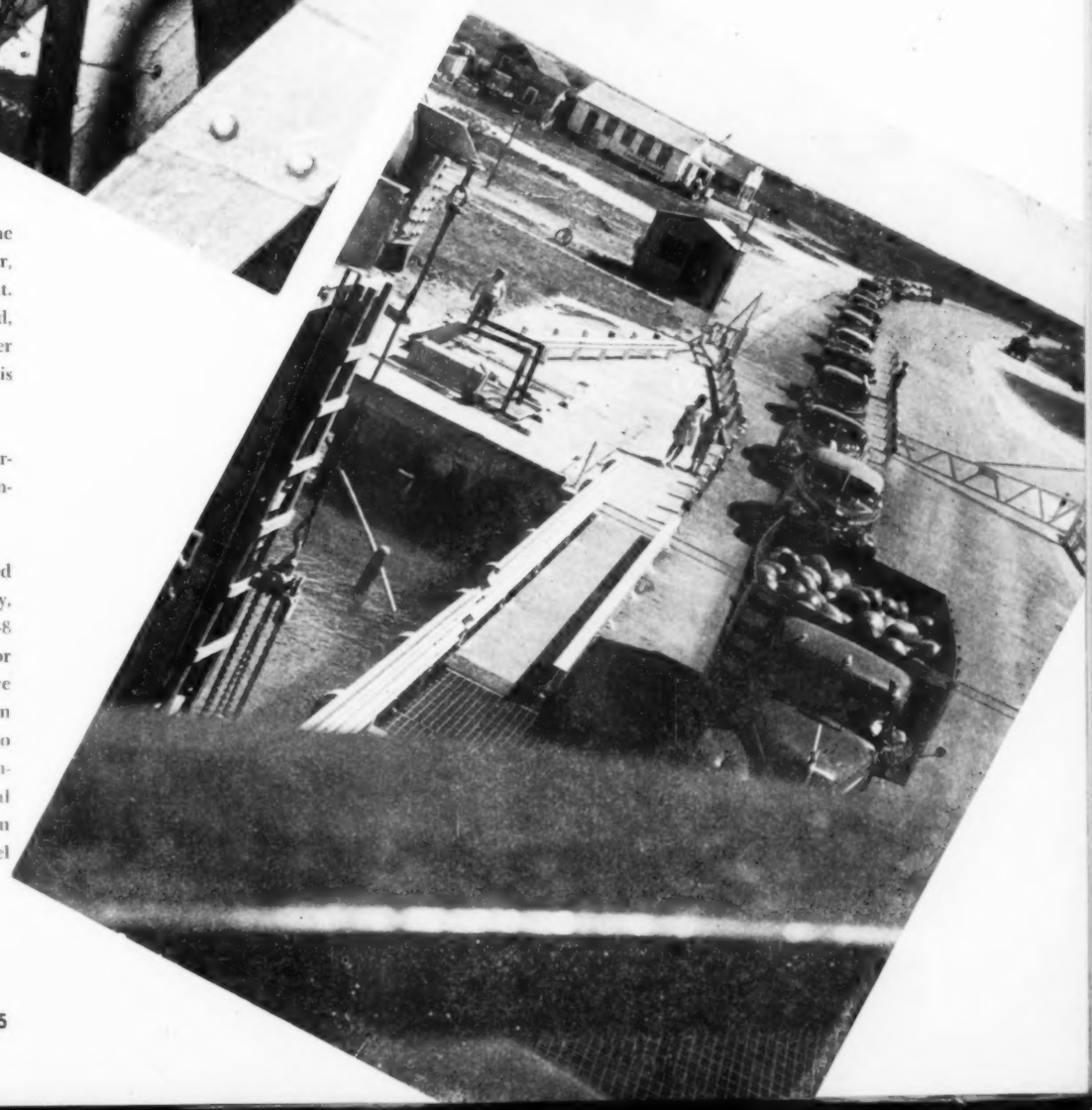
The engine, in the center of the boat, is direct connected to a propeller at each end. Headed away from Galveston, the pilot throws the indicator to "North," the engineer puts the Diesel in forward; for the return trip, the pilot's indicator says "South" and the engineer uses reverse. Simple.

The propellers are Coolidge, 62 in. in diameter and 39 in. pitch, and they are turned by the engine which has made such strides in the Gulf Coast tugboat trade, the Enterprise Diesel. Unlike many of this make of engine in Southern waters, however, the Enterprise on the *Galveston* is not a supercharged job, but is the standard DMG-8, of 8 cylinders, 12 in. bore by 15 in. stroke, turning out 514 hp. at 375 rpm.

Equipment, likewise, is standard. Fuel filters are built-in; lube oil is filtered by a Winslow unit. Starting air is furnished by a Quincy compressor. The pyrometer system is Alnor, with thermocouples for each cylinder. For auxiliary purposes, a Ford V-8 motor, gasoline, drives a fire pump and also serves the auxiliary air compressor and the bilge pump.



Port side view of Enterprise Diesel aboard "Galveston". Engine develops 514 hp. at 375 rpm. It operates 24 hours a day.



Mainland end of ferry system shows considerable traffic ready to board ferry which has 25 car capacity.

Captain of the ferry is William Stanley; the engineer is R. E. Harrington, of Port Bolivar, Texas, and he seems to like his power plant. For lube oil, says he, he sticks to Standard, SAE 30, and it gives him no trouble; neither does the Bendix fuel injection system on his Enterprise.

The Diesel was furnished through the Enterprise branch at New Orleans, La., under management of Paul Wabnig.

Says he, "You sometimes hear questions asked as to whether a Diesel will run continuously, with satisfaction, in reverse. Well, this DMG-8 Enterprise ought to answer that question, for she is operating in reverse for about twelve hours a day, or just as long in reverse as in forward. We wish to give credit, however, to the propeller manufacturers, the Coolidge Company, for furnishing propellers giving identical service in either direction. The combination of Coolidge wheels and the Enterprise Diesel is very satisfactory aboard the *Galveston*."

# VALVE SEAT INSERTS DISCUSSED

*By* E. H. VIELE*

This photomicrograph, at 1000X, above, shows a high test grey cast iron used by "Wausau" for inserts, containing 1.1% Mo., .50% Ni and .15% Cr. The structure shows graphite with pearlitic areas predominating. This material produces a low cost insert with a hardness of about 104RB—B-277; and is used by many engine manufacturers where operating temperatures are normal.

A recent development in a cast iron insert by "Wausau" is shown in photomicrograph #2, at 1000X, below, on which there is a patent pending. This also is high test grey cast iron but contains 2.50% Mo. and .40% Cr. Structure shows graphite, massive cementite and acicular pearlite. Such a structure has high resistant qualities to heat and growth. Inserts made of this material are being successfully used by engine manufacturers where operating temperatures are high.

LABORATORY tests of Valve Seat Inserts show many interesting results but not many facts. The apparent lack of correlation in these tests is a difficult problem to Engineers. In developing an insert the following must be considered; tensile strength, toughness, hardness, wear resistance, fatigue strength and corrosion resistance. By use of a proper base, iron or steel, the addition of various alloys in certain combinations makes it possible to obtain these qualities.

For those who have forgotten their metallurgy let us review the effects of the various alloying elements. The elements principally used are nickel, chrome, molybdenum, or molybdenum and chrome, copper and vanadium.

Molybdenum increases tensile strength, toughness, hardness and improves strength at high temperature—also increases wear resistance. This is due to formation of complex carbides which are more stable at high temperatures. When heat treated, material is more ductile with high tensile strength. In combination with nickel and chromium high toughness values and fatigue strength is obtained. This is especially true with steel. Molybdenum contents vary from .50 Mo. — 7.00% Mo. with varying amounts of nickel and chromium.

Chromium produces a double carbide of iron and chromium when added to iron and steel. This formation increases strength when percentage of chromium is kept low. It inhibits the formation of graphite in cast iron when further exposed to high temperatures. In large amounts hardness is increased and growth elevated temperatures is retarded. In cast iron chromium contents vary from small amounts as .10 to 3.5% and in steel from .50-5%. Special corrosion resisting inserts contain up to 16% chromium. This element is usually in combination with nickel forming stainless steel, having 18% nickel and 8% chromium. Various other high percentages of chromium are present varying from 16-26%. Prime importance of high chromium content is to resist oxidation and corrosion at high temperature.

Nickel acts as a graphitizer in cast iron and improves the strength, wear resistance and toughness of the metal. In cast iron this can vary from .10-3%. Special heat and corrosion resisting inserts contain larger amounts of nickel 12-15% in combination with 2-4% chromium, 5-7% copper, producing an austenitic structure. In steel, nickel increases tensile strength toughness and wear resisting properties. Nickel is usually added in combination with chromium and molybdenum in both cast iron and steel.

Nickel produces a solid solution in ferrite and as percentages increase up to 5%, martensitic structure is produced.

Copper acts as a graphitizing element in cast iron up to 1.5%, somewhat similar to nickel. However, it is usually present in combination with chroimum and molybdenum. It increases wear and corrosion properties; is present in heat resistant irons up to 4-7% copper.

Vanadium acts as a carbide forming element and stabilizes the cementite—also acts as a de-oxidizer in iron and steel. Its presence in small amounts increases tensile strength, toughness, hardness, wear resistance, and refines the grain.

As many of these alloys are very costly the development work in recent years has been towards lowering costs by using cast iron as a base and alloying it to produce excess amounts of molybdenum and chromium carbides, which resist heat and growth. Molybdenum carbides produce greater strengths than chromium carbides, therefore, larger amounts are used. When high contents of chromium are used alone the inserts become brittle.

* *Chief Engineer, Wausau Motor Parts Company.*

# Cold Facts . . . ...ON LUBRICANT PERFORMANCE

**This special refrigerating apparatus at Sinclair Laboratories tells an important story every day to research experts and refinery control technicians.**

**The thermometers, shown above inserted in lubricating oil samples, record temperature as cold is increased in the special refrigerating apparatus. Trained observers check the samples frequently, test for pour point. Sinclair, thus, makes sure that its lubricants retain full protective qualities even at sub-zero temperatures . . . when your specific application demands.**

**Such constant manufacturing control and research assures you that famous Sinclair lubricants . . . and all new Sinclair products . . . will give outstanding performance to meet your most exacting requirements.**

*Sinclair Diesel Oils*

**GASCON OILS**

Natural mild detergency for cleaner engines

Freedom from carbon deposits, crankcase accumulation, ring sticking

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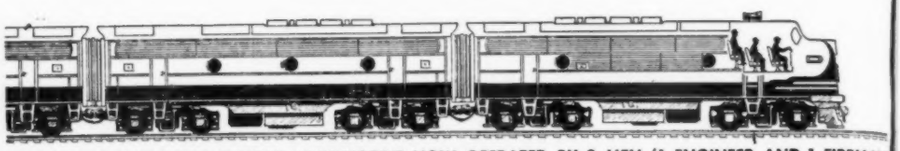
# DIESELS AND FEATHER BEDDING

THE accompanying illustration is taken from a paid advertisement appearing currently in newspapers throughout the country sponsored by U. S. railroads. The Railway Brotherhood doesn't seem to recognize the advantages of modern Diesel operation over the days when soft coal dust trickled down their necks and engineers breathed soot. It wants to force a change which well might be valid for steam operation but which is ridiculous when applied to labor saving Diesel operation. Nowadays the Diesel locomotive engineer is a "white collar man" as well as his fireman.

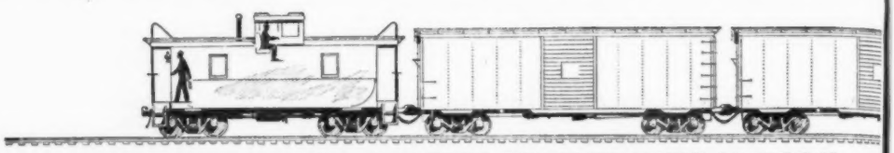
The advertisement points out further that "For sheer feather-bedding, this mock work proposal takes the cake. But it is only one of 44 rules demands filed by the leaders of the operating unions. . . . If all these demands were granted it would cost the railroads an added billion dollars a year.

"On top of these rules changes, the leaders of the operating unions have filed an additional demand for a wage increase of over 30 per cent. If granted, this would be an added cost to the railroads of $400,000,000 a year.

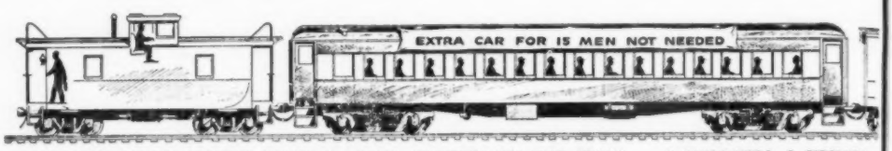
"In addition to this, an Arbitration Board has just granted a wage increase of 15½ cents an hour to the million employees represented by the 17 non-operating unions.



HERE IS A 4-UNIT DIESEL FREIGHT LOCOMOTIVE NOW OPERATED BY 2 MEN (1 ENGINEER AND 1 FIREMAN)



2 BRAKEMEN AND 1 CONDUCTOR COMPLETE THE CREW OF THIS TRAIN [One brakeman usually rides in the locomotive in freight service]

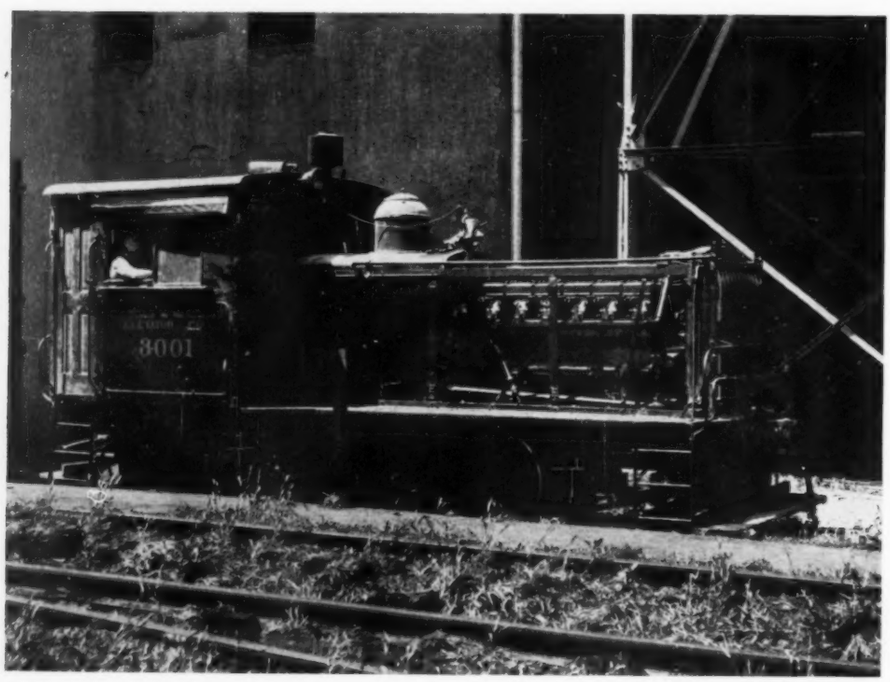



—BUT THE UNION LEADERS WANT 15 EXTRA "SITTERS" ON THIS TRAIN . . . 3 ENGINEERS, 3 FIREMEN, 6 BRAKEMEN AND 3 CONDUCTORS . . . TO GO ALONG FOR THE RIDE AT FULL PAY!

"Where will the money come from to pay these increases? They total several times as much as the railroads made in 1946 or will make in 1947. In July, the railroads filed an application for increased freight rates to close the gap which then existed between wage and material costs, and railroad revenues. Since then it has been necessary, because of further increases in wages and material costs, to supplement that petition and to ask for another freight rate increase.

"No other course is open."

# WHAT'S 15 YEARS TO A DIESEL?

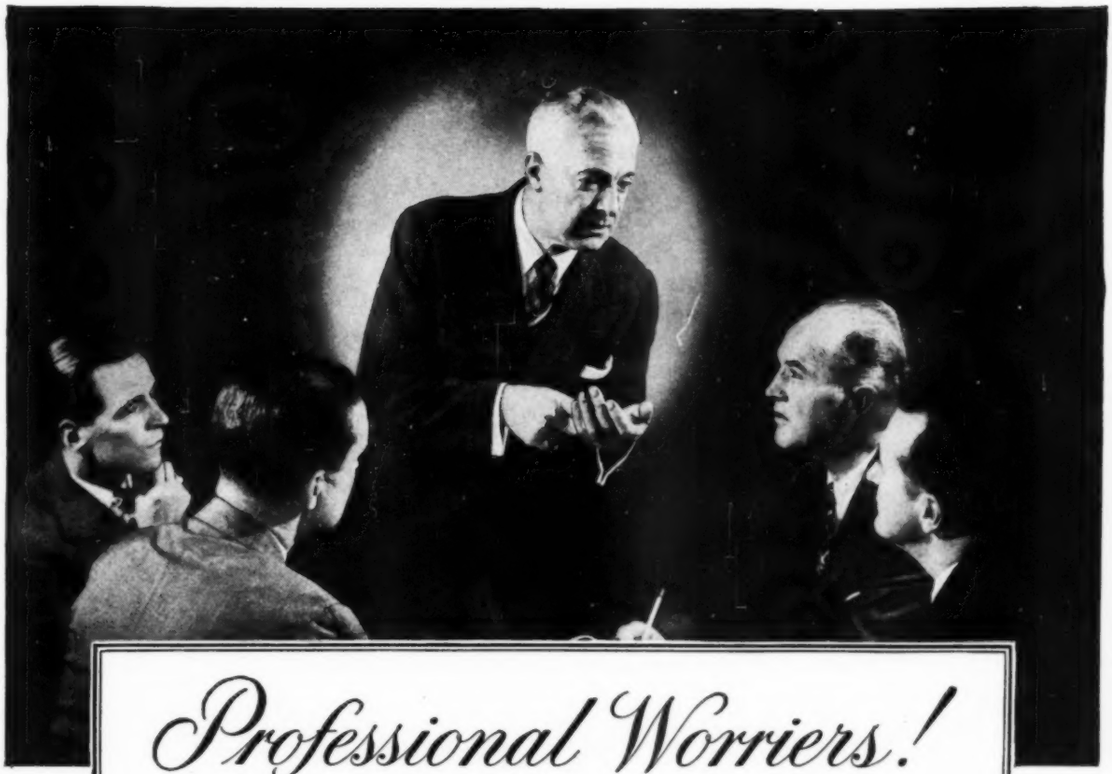



15-year-old Cummins Diesel still doing a good job in Plymouth locomotive

FIFTEEN years is a long life for any Diesel engine, but that is how long the Continental Grain Company of Kansas City, Mo., has been operating a Cummins Diesel Engine installed in a 30-ton Plymouth locomotive.

The Cummins Diesel engine recently underwent its annual overhaul period, with injectors and fuel pump the only parts replaced. Mechanic Arthur Stucker, who assisted in the overhaul, says, "there was nothing wrong with the engine to speak of; we didn't even change rings."

For a number of years, the Cummins-powered locomotive worked alongside a gasoline-powered 20 ton unit. A discussion of operating costs arose one day leading to a comparison of costs of the two units. Company officials found the Diesel-powered locomotive used only $130 worth of fuel in two years, while the gasoline bill for the other unit for a single year was $550.



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**Every business, time and again, runs into production snags. When the problem is *lubrication*, we're often called in to do the worrying. And eight times out of ten we come up with the right answer—*fast*. Because that's our job day in, day out, year after year—putting petroleum to work *efficiently*. This backlog of experience, coupled with the world's finest lubricants and fuels, is your best reason for calling Cities Service next time trouble calls on you.**

## CITIES SERVICE STOPPED TROUBLE HERE!

A screw products company in Cuyahoga Falls, Ohio, called on Cities Service for advice on machining a part of an intricate mechanism made of aluminum that required extreme accuracy and finish. Chillo Oil No. 22 was recommended. Thereafter, the manufacturer reported the machined work was not only well within the required tolerances, but the work had a mirror-like finish. Tool life was also phenomenally good.

A brick and tile company in Iowa suffered numerous failures of the main drive-shaft bearings in their Hammer Mill Crushers. Cities Service engineers recommended Pacemaker Oil No. 2. The last report from the company said that since they standardized on this lubricant, no bearing failures have occurred.

"We use Solvent No. 26 for cleaning surplus oil and grease out of electric clock movements and we find it unexcelled for this purpose" ...so writes the president of an Illinois watch repairing and rebuilding concern after continued use of this remarkable new Cities Service metal cleaning fluid.

A bus company executive in Cleveland, Ohio, recently said, "During the past four years, we used Cities Service Heavy Duty type oil with outstanding results—minimum wear, freedom from sludge and no engine failures—which has enabled us to give uninterrupted service to our customers."

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New York—Chicago

CITIES SERVICE

**ARKANSAS FUEL OIL CO.**
Shreveport, La.

Cities Service Oil Company
Room 246 Sixty Wall Tower
New York 5, N. Y.

Gentlemen: I have a production problem that involves lubrication. I would like to discuss it with one of your lubrication engineers, without obligation, of course.

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COMPANY_____

ADDRESS_____

CITY_____ STATE_____

# Exchange Your Diesel Maintenance Ideas

*Conducted by* R. L. GREGORY

*Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.*

### A Suggestion on Heating Fuel Oil

THIS department is in receipt of a letter from D. Potter, one of the operators at the Marshall, Michigan, Municipal plant, who is an ardent reader and follower of suggestions made in this section of DIESEL PROGRESS. His suggestion is as follows, quote:

"An idea occurred to me, which might be of some interest to readers of the Maintenance Section of DIESEL PROGRESS. Many Diesel plants such as ours have difficulty in heating their fuel oil, especially plants which have no steam facilities and who do not have heating coils in their mufflers.

My idea is to install a ¾ inch heating coil in the service tank, and make this coil a part of the closed system used in cooling the unit. This could be accomplished by connecting the incoming end of the coil to the pressure side of the water in the heat exchanger, and discharge the water from this coil back into the suction side of the soft water circulating pump.

Since we carry our head temperatures between 125 and 130 degrees, sufficient heat should be transferred to the oil in the service tank to make the fuel flow freely and eliminate the cold fuel oil problem."

The above suggestion has its merits and could be adopted. Of course a more ideal condition is to have coils in the service tank and the muffler, circulating the hot water from the muffler coils through the coils in the service tanks, by means of a small hot water pump. This to be an enclosed system also, with an expansion tank and relief valve in the system.

Another good means of heating fuel oil is to have a suitable electric heater in the line between the service tank and engine with an auxiliary ful pump in the circuit and so piped that you can circulate the fuel oil in the service tank and system before starting up, thus getting hot fuel for the start. Of course proper piping arrangements must be made with relief valves in the circuit to relieve excess oil pressure back in the service tank, or even back to the day tanks supplying the service tank.

Another thought in connection with Diesel plant fuel heating, might be suggested as follows: There are on the market today, several good makes of what are termed as "Package Boilers." These units are portable, so that they can easily be moved around, and can be had in small horsepower ranges from ten horsepower on up, with steam pressure ranges any where from 5 lbs. to 150 lbs. In plants that are confronted with heating problems, one of these little automatic light oil fired boilers is a handy thing. They can be used for heating purposes, either through radiators, ceiling heaters or circulating hot water. In such a setup provision can be made for heating the oil tanks and fuel lines. These package boilers are inexpensive, when one considers the various uses they can be put too around a plant and the amount of worry, time and labor saved by their installation.

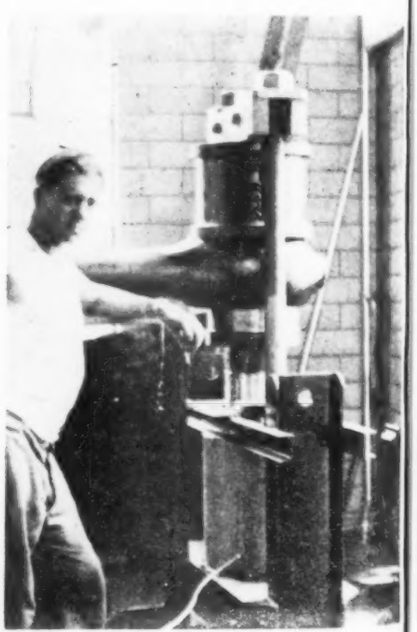
### Home Made Press

The accompanying illustration shows a handy home made press, used in removing and replacing the bushings in a connecting rod, which one of our mechanics recently designed and constructed. In making up this press he utilized, some angle and channel iron we had around the plant to make the frame, which is of welded construction. The side bars are adjustable up and down and use was made of the bars and bolts from the liner pulling equipment we have.

The snap shows a bushing being replaced in a connecting rod, after the worn bushing has been removed. The connecting rod was leveled up, the bushing squared up and entered, then the hydraulic jack from our liner pulling equipment was placed on the bottom plate, a small casting placed between the jack and bushing. The connecting rod is held down by means of a tie bar with a bolt on each side, which when tightened down, holds the connecting rod and bushing firmly in place. Then pressure is applied by means of the hydraulic jack and the bushing which is a press fit, firmly installed in the connecting rod. In removing a bushing the process is simply reversed.

This piece of equipment is both labor and time saving and was constructed out of scrap materials around the plant and use of our liner pulling equipment. It is not only used in this connection but can be used in any case, where a hydraulic press is needed. The jack and equipment will handle up to 200 tons pressure.

Ingenious homemade press used to install connecting rod bushing.



# STANDARD ENGINEERS NOTEBOOK

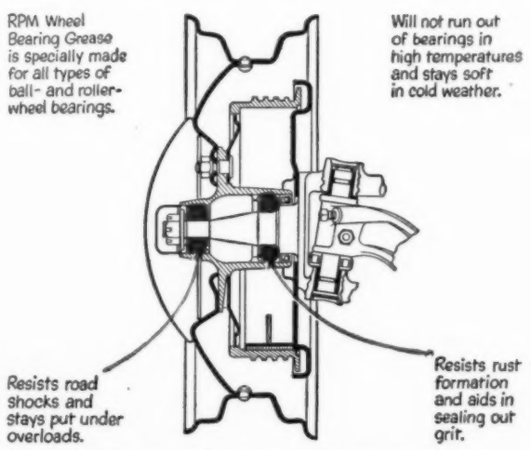
## Shock-resisting grease lengthens bearing life

To prevent extra wear and the necessity for replacing wheel bearings during the life of a vehicle, service them regularly with RPM Wheel Bearing Grease.

A short fibre lubricant, specially made for both ball, and roller wheel bearings, RPM Wheel Bearing Grease does not melt and throw out of bearings during hot operating conditions. It feeds slowly from bearing reservoirs and provides thorough lubrication for prolonged periods.

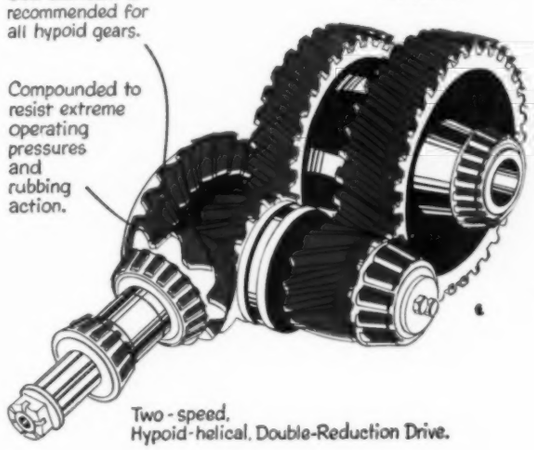
RPM Wheel Bearing Grease has the unusual ability of reducing the pounding of road shocks imposed on wheel bearings. It cushions the force of these shocks, minimizes metal fatigue and overheating and reduces vibration.

Extremely adhesive, RPM Wheel Bearing Grease helps maintain a seal around bearings against corrosive moisture. This seal also aids in keeping dust and grit out of bearings.


RPM Wheel Bearing Grease is specially made for all types of ball- and roller-wheel bearings.
Will not run out of bearings in high temperatures and stays soft in cold weather.
Resists road shocks and stays put under overloads.
Resists rust formation and aids in sealing out grit.

This drawing prepared with cooperation of Timken Roller Bearing Co

Trademarks, "Calol," "RPM," Reg. U. S. Pat. Off.


RPM Multi-Service Gear Lubricant is recommended for all hypoid gears.
Highly oxidation-resistant.
Compounded to resist extreme operating pressures and rubbing action.
Two-speed, Hypoid-helical, Double-Reduction Drive.

## New lubricant can be used in all type gears

The drive gears in automotive equipment operating under the most severe conditions are fully protected by newly-developed RPM Multi-Service Gear Lubricant. It resists the tremendous pressures and extreme temperatures encountered in hypoids as well as in heavily loaded conventional gears.

Special compounds in RPM Multi-Service Gear Lubricant react on tooth bearing surfaces and provide a safety coating. They also give the lubricant maximum resistance to foaming, better resistance to oxidation, and provide better protection from corrosion. The compounds are very stable in the blend and will not drop out of solution.

RPM Multi-Service Gear Lubricant is approved by the Timken Detroit Axle Co. and Buick Motor Division, General Motors Corp. for service use in hypoids, and the Army Ordnance Dept. as conforming to U. S. A. Specification 2-105-B. It is made in four grades: SAE 75 (for Alaska only), 80, 90 and 140.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

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# SUPERVISING & OPERATING ENGINEERS' SECTION

*Conducted by* R. L. GREGORY*

## "Unit installation and its effect on Daily Operating Problems" Part 7

WE have now proceeded with the erection of the unit in question, to a point where the major portion of the unit has been assembled on the bedplate, said parts consisting of the "A" frames, cylinder blocks, crosshead guides, crossheads with their connecting rods being fastened to the crankshaft, the camshaft installation, the assembly of the air and exhaust headers, the platforms over them and the assembly of the cooling water intake and exhaust headers.

The next step in erection was the installation of the fuel control shaft which is actuated from the governor, the fuel pumps and control rods, which govern the amount of fuel supplied to each individual cylinder. Those familiar with this type of unit, realize that the control shaft which is actuated by the governor, runs practically the entire length of the engine. They also realize that in order that each fuel rod work freely and properly, there must be absolutely no binds or pinches at any point along this assembly. Four of these fuel pumps are shown in Figure 1, with five more pumps not shown in the picture.

Figure 2 shows the throttle valve and governor arrangement, the housing covering the governor gears and the automatic safety stop mechanism just below the throttle valve. This type of safety mechanism is standard equipment on most of the units of this size. The erectors took a great deal of pains in seeing that these governor gears meshed properly with no high spots or binding, that the lubrication of these gears was properly hooked up with all joints tight, so that ample lubricant was delivered to these gears at all times. The linkage and timing were gone over several times to see that each individual connection and moving part was properly aligned and securely fastened in position.

Upon completion of this phase of the work, the fuel oil header and branch lines, and the oil lines which supply lubricant to the cams and gears driving the lubricators were all installed. Upon completion of this work the individual cam shaft covers were installed and the cam shaft completely enclosed.

While the erectors were engaged in this work, other workmen were installing the spill pipes that carry the oil from the piston heads and crossheads back into the crankcase. The sidewalls and internal parts of the crankcase were then all washed and cleaned with kerosene and the whole internal surface of the crankcase was given a coat of white enamel.

Other workmen were busily engaged in cleaning up the wiper rings assemblies and installing the same. These assemblies are bolted tightly to the bottom of the cylinder. At periodical predetermined points the studs are drilled out and used as a connection for passing the cylinder oil from the lubricator lines up into the lines which furnish the lubricant to the cylinder oil ports. Each assembly is equipped with a drain which in turn connects to a common drain pipe and carries the used oil off to a collecting container, from which it can be removed and filtered for future use.

Still other workmen were engaged in cleaning up the pistons as shown in Figure 3. When these were all cleaned and checked for blemishes, the rings were installed in the ring grooves of the piston heads and the pistons were then ready for installation. Before installing the pistons the erectors tightened the tie rod bolts. This procedure consisted of using a special hydraulic jack, equipped with a pressure gauge. This jack was placed on the upper tie rod nut and a predetermined amount of strain was placed on each upper tie rod nut, so that when all nuts were tightened down, the same strain was theoretically applied to each tie rod bolt.

Upon completion of this job, the pistons were installed in their respective cylinders and bolted to the crossheads. With all pistons in place the cylinder heads were next installed and tightened down, and the attendant cooling agent piping, fuel oil piping and starting air piping and header installed and bolted in position. With this feature finished the erectors then checked the clearances between the pistons and heads with the pistons at top center position. In this particular unit this clearance was set at 11/16 in. and adjustments made to give this clearance on each piston. When this work was completed to the satisfaction of the erectors, the inspection doors were placed temporarily in place in order to keep dust and dirt from getting into the crank case.

In next month's issue the writer will discuss the installation of the piping of the air intake and exhaust, the silencers, air filters and some of the unique features of this installation.

Figure 1

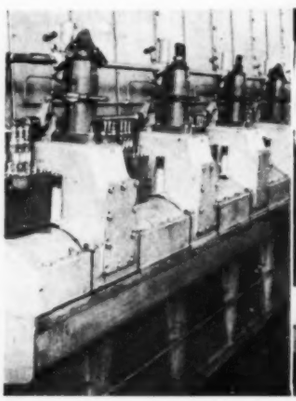


Figure 2

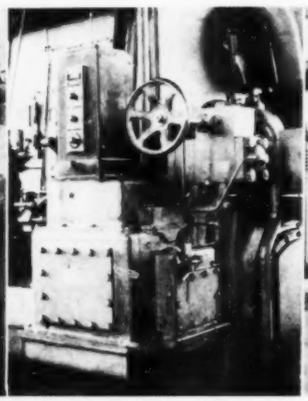
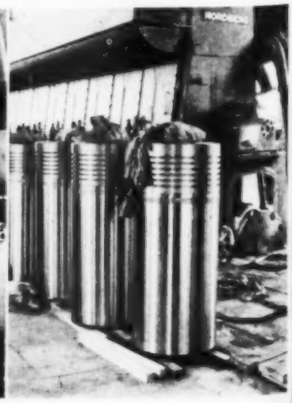
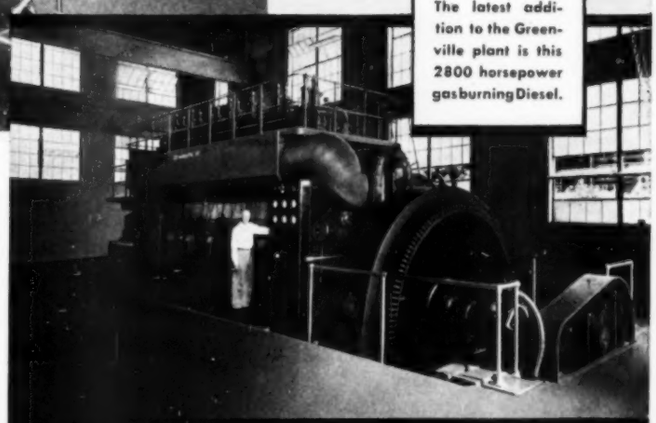


Figure 3



* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

# NUMBER 5 for Greenville, Texas



The latest addition to the Greenville plant is this 2800 horsepower gasburning Diesel.

THIS 9650 horsepower Nordberg Diesel engined municipal power plant at Greenville, Texas is another of the many satisfied users that continue to place repeat orders for additional Nordbergs because of the years of excellent performance of their engines. Following the initial installation of two engines in 1933, units were added in 1938, 1942 and 1946, the last two installed using natural gas for fuel.

The performance of Nordberg Diesels at Greenville has been noteworthy. In addition to being dependable, they have been economical, the latter being shown by the fact that Greenville has a lower rate than any city of comparable size in Texas. If you are considering power units, investigate the merits of Nordberg Diesel Power.

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These 1000 and 1450 horsepower Nordberg units comprised the initial installation at Greenville.

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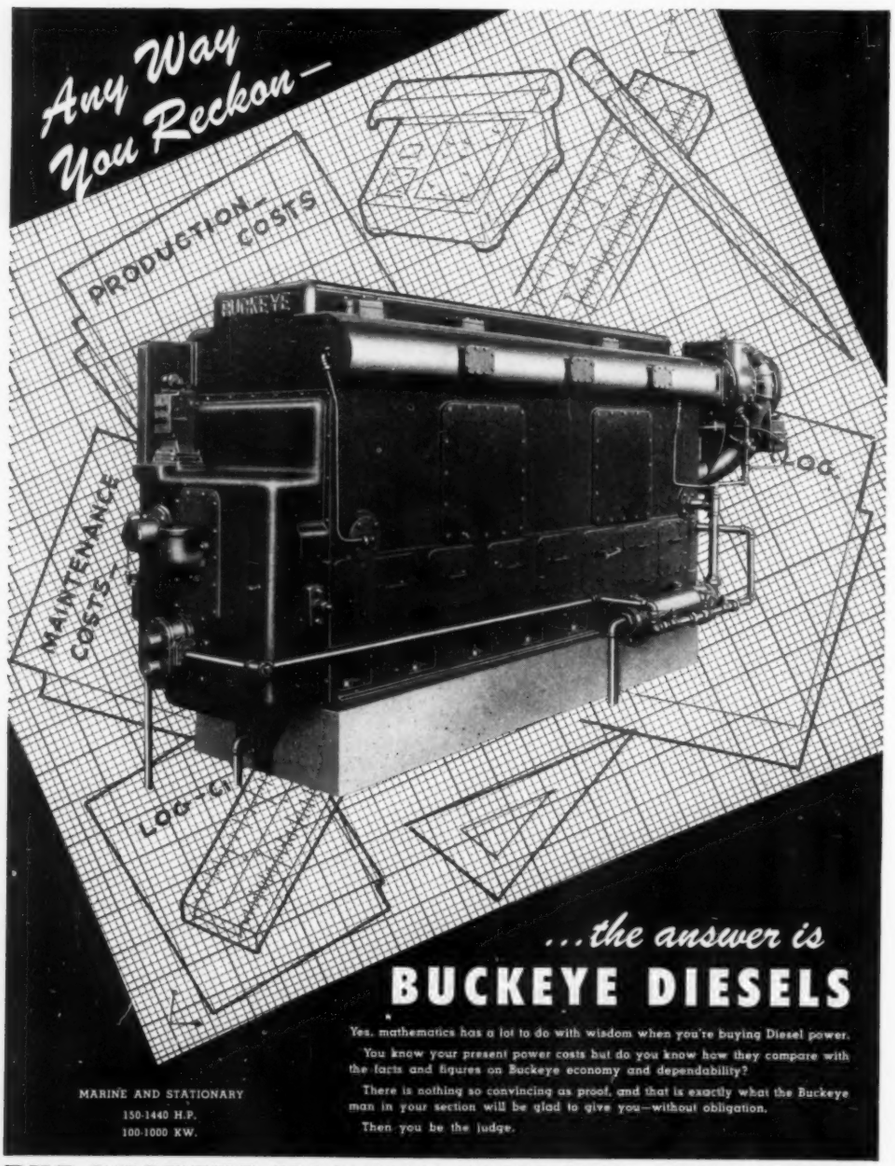
**NORDBERG**
**DIESEL ENGINES**

NORDBERG MACHINERY

## Society of Naval Architects and Marine Engineers to Meet November 12-15

THE 55th Annual Meeting of the Society of Naval Architects and Marine Engineers will be held at the Waldorf-Astoria, New York City, on November 12-15, 1947. A series of nine papers will be presented during the meeting. The Annual Banquet will be held on Friday evening, November 14, at 7:30 p.m. at which time Vice Admiral Edward L. Cochrane, USN, President of the Society, will preside. On Saturday morning, November 15, the Society will visit the United States Merchant Marine Academy at Kings Point, Long Island, N. Y., at which time a plaque in memory of the late Vice Admiral Howard L. Vickery, USN, will be unveiled. The Society has recently presented this plaque to the Academy for installation at the Vickery Gate. The Plaque honors Admiral Vickery for his "outstanding success in directing the construction of merchant vessels in World War II."

The festivities will close with the very popular Dinner Dance of the Society in the Grand Ballroom of the Waldorf-Astoria on Saturday evening, November 15.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...the answer is
BUCKEYE DIESELS
Yes, mathematics has a lot to do with wisdom when you're buying Diesel power.
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There is nothing so convincing as proof, and that is exactly what the Buckeye man in your section will be glad to give you—without obligation.
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## Heat Transfer Engineer Addresses Chemical Engineers

THE annual meeting of the Oklahoma Section of the American Institute of Chemical Engineers at Bartlesville, Oklahoma, on October was the occasion for an address on "Heat Transfer" given by H. J. Kinkade, sales manager Oil Field and Heavy Industrial Units, Young Radiator Co.

H. J. Kinkade

Mr. Kinkade's technical presentation of his subject was aptly illustrated by the use of slides showing equations incident to the problems of efficient heat transfer under varying conditions. By way of summary, Mr. Kinkade listed the following factors as affecting over-all heat transfer from a fluid inside tubes to another fluid outside the tubes: 1. Mean effective temperature difference between the two fluids. 2. Amount of interior surface. 3. Amount of exterior surface. 4. Material of tubes. 5. Thickness of tubes. 6. Film factor inside tubes. 7. Film factor outside tubes.

## New Eaton Booklet

THE 1947 edition of *Products of Eaton* has recently been published by the Eaton Manufacturing Company. This new booklet describes and illustrates the complete line of Eaton products. Of special interest to the Diesel field are the valves, hydraulic valve lifters, and valve seat inserts offered by the company. Additions to the Eaton line during the past year include dynamometers, dynamatic oil well draw works brakes and dynamatic drives. Copies of this booklet are available by writing to the Advertising Department, Eaton Manufacturing Co., 739 East 140th St., Cleveland 10, Ohio.

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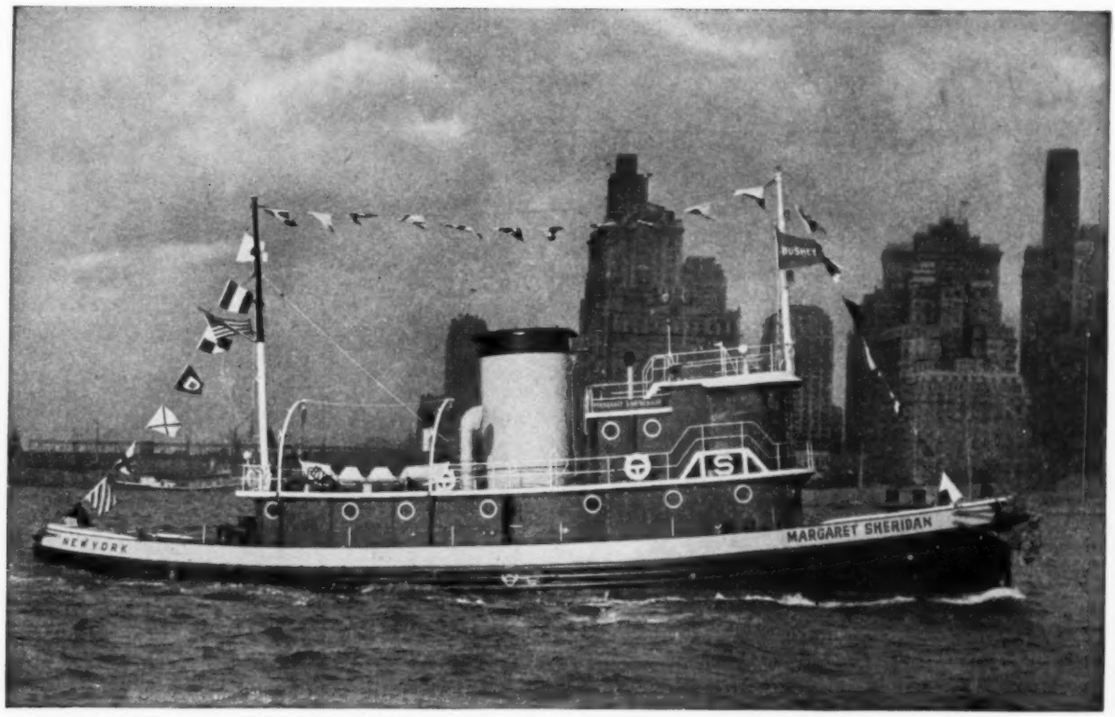


THE all steel HULL represents the ultimate in design and the superb in construction. The MASTER'S STATEROOM and CREW QUARTERS incorporate the practical combination of off-watch comfort, quiet and interior passage communication. The PILOT HOUSE provides clear all point vision; contains practical and complete navigation and communication equipment. The LOWER ENGINE ROOM provides outstanding acessibility to the power-packed main engines, and all other machinery. The UPPER ENGINE ROOM contains spacious, wide cat-walks; it is ideal for complete remote controlled engine and power operation. The GALLEY and MESS combine completeless, convenience, comfort and efficiency.

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## A.S.M.E. Annual Meeting December 1-5 In Atlantic City

THE 1947 Annual Meeting of The American Society of Mechanical Engineers will be held in Atlantic City, N. J., December 1-5. This will be only the third time in the Society's 68-year history that it has held the largest of its national gatherings outside of New York City. The 11th Annual Meeting, in 1890, was held in Richmond, Va., and the 60th, in 1939, was held in Philadelphia.

A desire to avoid the hotel congestion in New York which is expected to result from meetings of the United Nations was given as a chief reason for the change. The decision was reached following a vote of members. The Society's total membership is more than 22,000.

The Chalfonte and Haddon Hall will be the Atlantic City headquarters hotels. They have guaranteed 2,700 rooms for the meeting. Usually the attendance totals about 6,000 but it is expected to exceed that figure greatly this year. Some 200 engineers, scientists and industrialists take part in the program consisting of five days of continuous technical day and evening sessions.

In 1948 the ASME expects to return to New York to hold the Annual Meeting at the Hotel Pennsylvania.

## George W. Codrington Honored

For a job well done—Secretary of the Navy John L. Sullivan is here shown awarding President Truman's Certificate of Merit to George W. Codrington for his outstanding service in the production of Diesel engine equipment used by Navy ships and submarines during World War II. Mr. Codrington is a vice president of General Motors and general manager of this firm's Cleveland Diesel Engine Division. The award was made in the Navy Department at Washington on September 25th.

## Reprints of Diesel Course Available

THE Pennsylvania State College has made available for limited distribution a booklet embodying reprints of some sixteen papers comprising a Short Course for Teachers of Diesel Engineering given June 24 to July 6, 1946. The papers are comprehensive of their subjects and were prepared by well known authorities in the fields of engineering, teaching, industry, and publication. Some typical subjects are: Lubricating Phenomena; Diesel Fuels; Injection and Combustion; Supercharging; Diesel Design; Diesel Research; History of Diesel, and others.

Mimeograph reprints bound in paper cover make up the booklet of more than 150 pages with many charts, graphs and illustrations. Price $1. Address your order to Charles M. Graff, Central Extension, The Pennsylvania State College, State College, Pennsylvania.


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Your new Whitcomb locomotive will be available for service near 100% of every 24 hours. The average is between 92% and 98%—THAT'S HIGH.

Your new Whitcomb will show a substantial decrease in operating and maintenance costs, around 50% less than the displaced steam job—THAT'S LOW.

Your new Whitcomb will be dependable 100% of the time, executing the toughest switching and hauling assignments quickly and efficiently—THAT'S GOOD.

And, if you will consult with Whitcomb engineers and place your haulage problem before them, they will recommend the locomotive best suited to your specific needs. Not too big or too powerful a locomotive, that would be extravagantly expensive to operate and maintain, nor one that is too small with too little power that couldn't possibly do what you expect of it, but one THAT'S JUST RIGHT.

*DIESEL ELECTRIC LOCOMOTIVES 25 TO 95 TONS*
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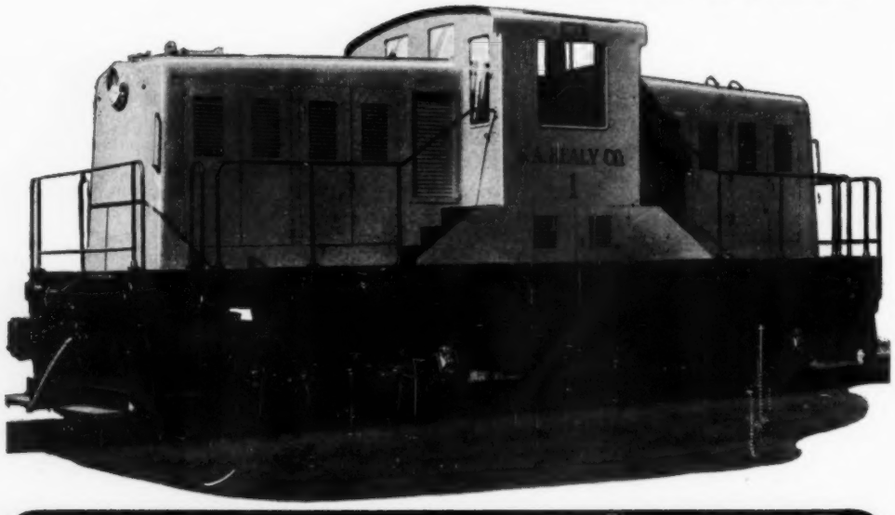

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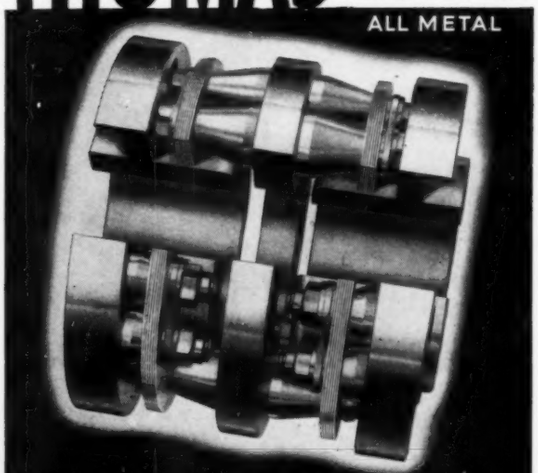

provide for Angular and Parallel Misalignment as well as Free End Float...
BACKLASH, FRICTION, WEAR and CROSS PULL ARE ELIMINATED
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- Indicator and transmitter are ruggedly constructed to withstand the excessive vibration and the extreme shock to which all marine instruments are subjected
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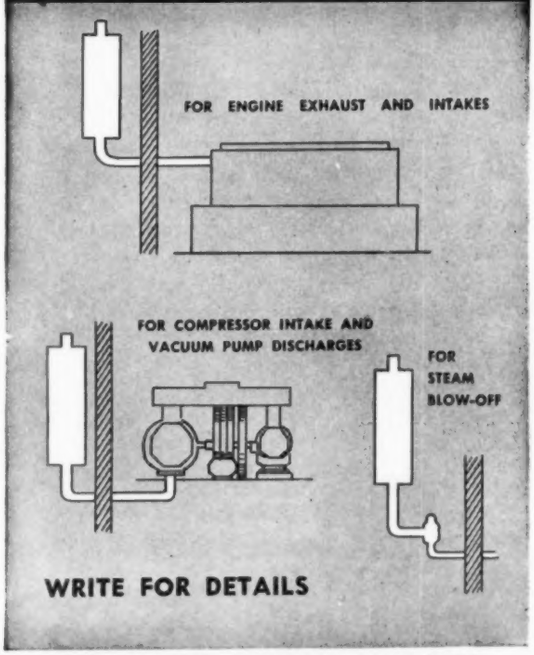


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**THE MAXIM SILENCER COMPANY**
94 HOMESTEAD AVE., HARTFORD 1, CONN.

**Mapleleaf . . .** *Continued from page 61*

tested in sea trials and performed satisfactorily. Now after more than a month of constant towing service, the owners are satisfied with a job well done.

This repair is the first permanent repair ever known to be made on a marine crankshaft without the removal of the shaft from the engine. Metalock engineers accepted a challenge in tackling a job such as the one described above and completed it successfully. The advantages in using the Metalock process become even more aparent where larger engines are concerned and where the cost of engine disassembly alone would cost more than repair by the methods described above. The method is especially good for repairing incipient cracks in shafting. The metal used in Metalock repairs is a special grade of stainless steel which has properties which cause it to harden as it is forced into the parent metal as well as filling in flaws in the parent metal.

A GOOD OIL FILTER PAYS ITS WAY
By Preventing Premature Wear and Replacements
BY CUTTING OIL CONSUMPTION
BY SAFEGUARDING ENGINE LIFE

There is no one accessory that more quickly pays its way, on an engine, truck, bus, car, or any motorized equipment, than a *good* oil filter.

MICHIANA Diesel Oil Filter...Capacities to 3266 H. P.

For a filter that does the job it is designed to do can serve more than anything else to: (1) eliminate unnecessary wear and maintenance, (2) keep gum and sludge at a minimum, (3) assure more extra miles of lower cost operation.

The MICHIANA Filter is this kind of accessory. It was perfected by MICHIANA engineers after extensive experience and practical field applications. As a result, operators of engine-powered equipment report that the principle and simplicity of MICHIANA Filters provide for the maximum in oil-cleaning effectiveness.

Consider the filters you use from an engineering standpoint and you will be convinced that MICHIANA Filters meet your most stringent requirements—with extra savings and economy.

**MICHIANA PRODUCTS CORPORATION**
**Michigan City, Indiana**

**MICHIANA OIL FILTERS**

*Bulletin 45-D describes filters for gasoline and Diesel engines—Send for your copy today.*

## New Type Hose Clamp

Aeroseal hose clamp utilizes worm-type drive f uniform clamping pressure—manufactured by Aircra Standard Parts Division, Breeze Corporations, In Newark, N. J.

## Personnel Changes In Atlas New York Office

J. D. SCANLON, for several years Secretar of Atlas Diesel Engine Corporation, wholl owned subsidiary of Atlas Imperial Diesel En gine Company in New York, has been ap pointed Branch Manager in New York.

K. H. Nilsson, who formerly was Sales Engi neer in New York and for the past several years Manager of the company's Montreal branch, will return to New York as Sales Man ager.

J. W. Camp, Vice President of the New York subsidiary since 1934, will be distributor of Atlas engines in the states of North Carolina South Carolina, Georgia and Florida, and will make his headquarters in Miami.

## 38th Annual Motor Boat Show

ARRANGEMENTS have been completed for the Thirty-eighth Annual National Motor Boat Show to be held in Grand Central Palace, New York, opening to the public Friday evening January 9th and closing Saturday evening January 17th, 1948. Show committee members are: Henry R. Sutphen, George W. Codrington, Ralph G. Klieforth, and William G. Wood

## Lanova Corporation Changes Address

THE Lanova Corporation recently announced that it has moved to its new laboratory and offices at 38-15 30th Street, Long Island City L New York.

# B&W Diesel Engines

-leading in the maritime world

Burmeister & Wain who built the first ocean-going motor vessel have for nearly half a century been leading in the construction of Diesel engines.

Burmeister & Wain and their licensees have built stationary and marine Diesel engines totalling about eight million horsepower.

**BURMEISTER & WAIN · COPENHAGEN · DENMARK**

## A.S.M.E. Elects E. G. Bailey National President

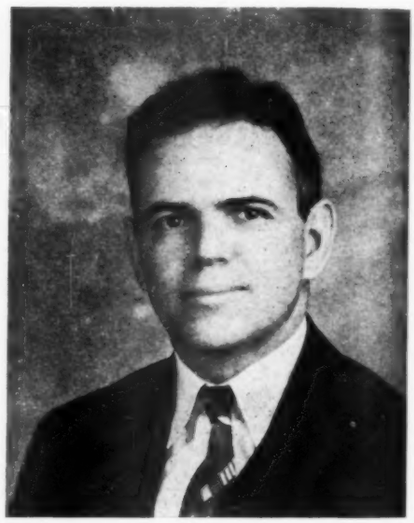
THE election of E. G. Bailey, vice president of The Babcock and Wilcox Company, New York, as the next national president of The American Society of Mechanical Engineers, was recently announced. Four regional vice presidents and three directors-at-large also were named.

Mr. Bailey, who succeeds Eugene W. O'Brien of Atlanta as president of the ASME, is noted as an authority on fuels, combustion and power developments. His home is in Easton, Pa.

Other officers elected are: Regional vice presidents—Frank M. Gunby, associate of Charles T. Main, Inc., 201 Devonshire Street, Boston; Paul B. Eaton, head of the mechanical engineering department of Lafayette College, Easton, Pa.; Thomas E. Purcell, general superintendent of power stations, Duquesne Light Company, Pittsburgh; J. Calvin Brown, head of the engineering firm of J. Calvin Brown, Los Angeles.

## South American Students Study Diesel at Freeport, L. I. Plant

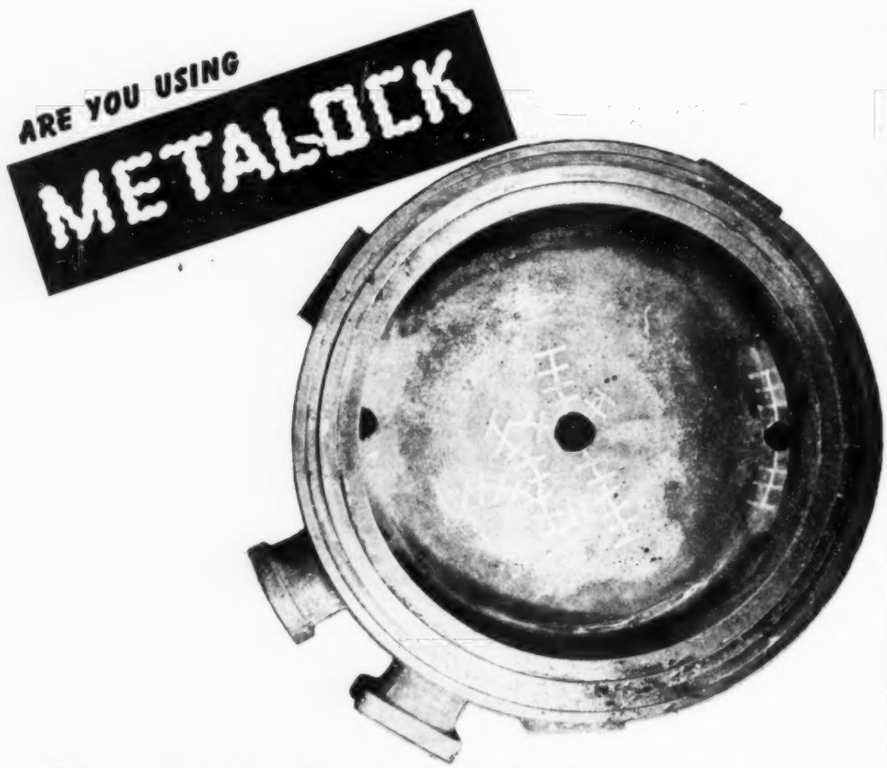
SINCE August of this year, four young engineers from Colombia have been studying Diesel under the direction of Thomas Moore, Superintendent of Freeport's municipal power plant out on Long Island, N. Y.



Thomas Moore, Jr.

Tom Moore who replaced Superintendent T. F. Dunn last February planned this experimental training program before he returned to the U. S. from South America where he was stationed during the war. From 1944 to 1947 Moore served as installation engineer for Ingersoll Rand in Venezuela setting up several gas engine plants in that region. His last assignment was the planning of a municipal power plant for the city of Cucuta, Colombia which included the installation of six 600 hp. Ingersoll-Rand engines. It was during this period that arrangements were made for the training program now in progress. The four student engineers prior to coming to Freeport spent time at the Ingersoll-Rand plant and at General Electric in Schenectady learning the manufacture and construction of the equipment they will operate when they return to Colombia.

At the present time the Freeport plant is experimenting with the idea of vapor phase or high temperature cooling for their Diesel engines. Mr. Moore who became interested in this method of cooling in 1937 is confident that it will be accepted throughout the industry within five years.


This is one of eight cylinder heads of a 32" bore marine diesel engine which were repaired with Metalock in 1945 for one of the larger oil companies. These heads have been in constant service since that time without leakage or extension of former crack.

To meet your shipping dates and schedules use Metalock to cut your maintenance costs and eliminate unnecessary tie-ups. Investigate Metalock service which is endorsed by leading manufacturers approved by principal underwriters and surveyors and accepted by hundreds of enthusiastic users.

Keep Your Engines Turning

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# Cut Engine Trouble, Wear Breakdowns, Teardowns--

## *with Fram Filters and Cartridges!*

**FRAM HEAVY-DUTY LUBE OIL FILTERS**

**FRAM FILCRON FUEL OIL FILTERS**

Made in two sizes to service all types of Diesel engines. May be used individually or in multiple to meet any desired capacity. Scientifically designed, guaranteed to remove all solid particles from fuel.

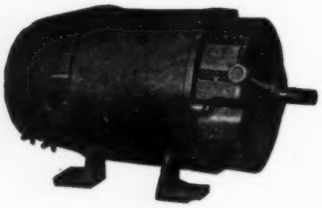
Fram Filcron Fuel Oil Filters contain the amazing Fram Filcron cartridge, which proved itself an outstandingly efficient filtering agent in widespread Army and Navy use during the war. Made up of stacked cellulose discs, the Filcron cartridge removes particles as small as one micron (.000039 of an inch) in size . . . thus provides absolutely clean oil to injectors, saving maintenance and money.

For information on Fram Lube or Fuel Oil Filters, write: Fram Corporation, Providence 16, R. I. *In Canada:* J. C. Adams Co., Ltd., Toronto, Ontario.

**FRAM** OIL AND MOTOR CLEANER

*Cleans the Oil that Cleans the Motor*

# GENERATORS AC and DC



**Well-known for their rugged design, efficient performance, long life and minimum maintenance, whether powered by electric, gasoline, or Diesel equipment. Backed by over ½ century of manufacturing and designing experience, Kurz and Root generators are now serving industries throughout the world**

**Illustrated are AC generators, only 2 of the many different types developed and designed to fit specific needs and applications, (upper left) two-bearing self-excited type; (lower right) two-bearing direct connected exciter type.**

**DC generator (left) two - bearings, self excited type Can also be furnished with direct connected exciter. Both AC and DC generators can be furnished in the single bearing, flange-mounted type for special mounting requirements. Ball bearing construction is used throughout. Complete data upon request.**

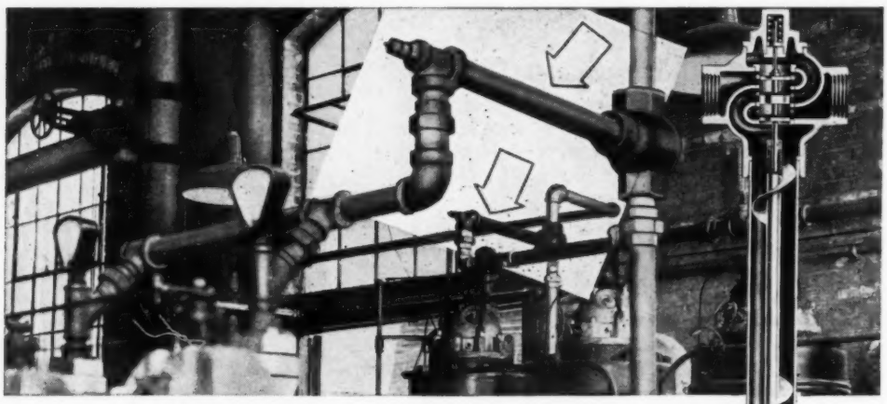
AC-DC GENERATORS

**KURZ and ROOT Company** Since 1898

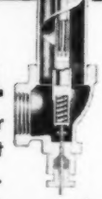
APPLETON · WISCONSIN

.....and DC motors and motor generator sets





*Sarco Blenders on Diesels*



## LOW COST JACKET WATER CONTROL

Correct cooling water temperature benefits four ways—in engine efficiency, in amount of lubricating oil used, in the elimination of unnecessary shutdowns and repair bills, and in conservation of water supply.

The Sarco Blender is a simple, sturdy, three-way thermostatic mixing valve. It automatically recirculates a varying portion of the cooling water and maintains constant jacket water temperature.

Valves are of the double-ported, fully balanced piston type. Operation is unaffected by differing or fluctuating water pressures within reasonable limits. Sizes up to 6". Pressures to 150 lbs. Ask for Bulletin 700.

**SARCO** SAVES STEAM

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### Nordberg Appoints Four Vice Presidents

THE promotions of four Divisional Managers of Nordberg Manufacturing Company, Milwaukee 7, Wisconsin, to Vice-presidencies of the company is announced by R. E. Friend, president. Division managers appointed company vice-presidents are Roland W. Bayerlein, Heavy Machinery; H. H. Talboys, Railway Equipment; D. A. Cheyette, Crusher; and R. R. Shafter, Process Machinery.

Roland W. Bayerlein

Mr. Bayerlein has been associated with Nordberg Manufacturing Company since 1919 when he started apprenticing in Nordberg shops as a co-op engineering student of Marquette University. After receiving his degree in mechanical engineering from Marquette in 1924, Bayerlein served as a sales engineer, doing estimating, making power plant analysis, and formulating proposal specifications for steam and Diesel engines. In 1933 he became Assistant to the Vice-President in charge of sales and engineering of the Heavy Machinery Division and two years later was appointed manager of that division.

### New Sheppard Aircooled Marine Diesel

THE smallest marine Diesel . . . which is also the only aircooled marine Diesel available . . . made its first appearance at the recent Blessing of the Fleet. Having only one cylinder, with a 3 in. bore and 4 in. stroke, it develops 3½ continuous hp. at 1800 rpm. Push button electric starting is standard equipment . . . hand cranking is optional. The engine is equipped with the Paragon reverse and 2:1 reduction gear.

# SIMS

## HEAT EXCHANGE EQUIPMENT

TEXTILE TYPE HEAT EXCHANGERS

CAUSTIC SODA RECOVERY SYSTEM

JACKET WATER HEAT EXCHANGERS and EXHAUST GAS BOILERS for INTERNAL COMBUSTION ENGINES

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**THE SIMS CO** • Box 1096A, Erie, Pa.



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## NEW

## INTAKE CLEANER-SNUBBER

Here's an intake Cleaner-Snubber that's completely new in design. It's EASY TO INSTALL—attaches to the intake in a vertical, horizontal, or upside-down position. It's EASY TO SERVICE—the viscous-coated impingement type nonferrous metal element is held by three snap fasteners that allow quick removal for cleaning. No nuts or covers to remove. It's LONG LASTING—heavy steel construction gives it long service life. And it's EFFICIENT—cleans and effectively silences intake air. Write for bulletin on Model ICS.

**BURGESS-MANNING COMPANY**
749-A EAST PARK AVE., LIBERTYVILLE, ILLINOIS

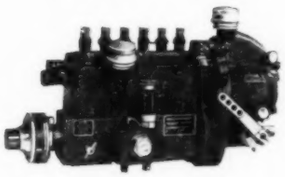
BURGESS SNUBBERS · BURGESS SNUBBERS



*the heart of your diesel deserves The Finest!*

## BOSCH FUEL INJECTION PUMPS

*immediate delivery! new!*



**ALSO AVAILABLE. . . LARGE STOCK BOSCH SPARE PARTS**

WRITE, WIRE, PHONE YOUR REQUIREMENTS TODAY!

**BENJAMIN'S FOR MOTORS**
2124-28 MILL AVENUE • BROOKLYN 10, N. Y.
Tel. ESplanade 7-9090

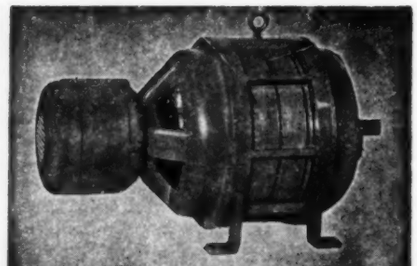
## Burlington AUTOMATIC Synchronizer

This low cost unit provides positive protection against the hazards of incorrect paralleling of A.C. generators. It automatically controls circuit breaker closure when generator frequency, voltage and phase are correct.

Only one synchronizer needed for any number of generating units.

Write for further details.

**BURLINGTON INSTRUMENT COMPANY**
**1509 FOURTH STREET, BURLINGTON, IOWA**



Columbia A.C. and D.C. Generators are built to meet highest performance standards. Complete range of application, including light, power, ship auxiliaries, or custom designed units.

D.C. UNITS range from 7½ to 200 KW. A.C. UNITS range from 6¼ to 300 KVA. Speeds and other specifications to meet requirements. Write for full information.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., N.E., Cleveland 14, Ohio

COLUMBIA
GENERATORS
A.C. and D.C.

Forged Steel Design made to special order for all types and sizes of air and gas compressors—from 2" to 16" diameter.

Valve plates and discs of all designs in alloy steel, stainless steel, monel, bronze and other metals.

Write for estimates and send samples or blueprints of your old valves.

J. H. H. VOSS CO., INC.
785 East 144th St. corner Wales Ave., New York, N.Y.

## Diesel Compression Tester By Bacharach

BACHARACH Industrial Instrument Company has developed a new Diesel compression tester for engine maintenance, repair, and rebuilding work. Simplicity of use is one of the distinctive features of the instrument. The fuel injector is removed from the cylinder to be tested and the adapter of the compression tester is inserted into the injector opening. The adapter is designed to be held in place by the same means that is used for holding the fuel injector.

After attaching the tester, the engine is started and operated at either cranking or idling speed. The engine pressure is communicated to the dial gauge through a "cartridge-sealed" trapping device in the adapter, and the gauge pointer swings gradually to the maximum compression pressure. When the pointer has reached this position it remains stationary, permitting close, accurate reading. The air pressure in the gauge may then be released by depressing a push-button vent valve.

The tester is regularly supplied with a "universal" adapter which serves 54 types of Diesel engines. Other standard adapters are available for practically every commonly-used make of Diesel engine.

Complete details and specifications are given in Leaflet 605 which can be obtained from the manufacturer—Bacharach Industrial Instrument Company, 7000 Bennett Street, Pittsburgh 8, Pa.

## Nugent Oil Filter Bulletin

A NEW bulletin has been recently published by Wm. W. Nugent and Company illustrating and describing the complete Nugent line of Diesel engine fuel and lubricating oil filters. The bulletin describes the two types of filter—the bag type and the absorbent cellulose depth type. The bag type filters are made in seven sizes with capacities ranging from ¼ to 400 gallons per minute. They are equipped with a built-in relief valve. The Nugent absorbent type filters, utilizing the cellulose type cartridge are available in ten sizes with capacities of 1/3 to 650 gallons per minute. Either type may be utilized for full flow filtering however it is recommended that for this type of service both the bag type and absorbent type filters be used together as first and second stage filters. The bulletin also describes Nugent fuel oil filters in both single unit and Duplex models.

Write for this interesting bulletin today. Bulletin 7B—Wm. W. Nugent & Co., Inc., Mfrs., 410-12 N. Hermitage Ave., Chicago 22, Ill.

## Bibliography *Continued from page 43*
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## Intake Cleaner-Silencer Announced by Burgess-Manning Company

New Burgess-Manning cleaner silencer

DEVELOPMENT of a new intake air cleaner-silencer for use on internal combustion engines, compressors, or blowers has just been announced by W. L. Manning, president of Burgess-Manning Company. Designated as Series ICS, these units are available in pipe sizes from 3/4 inches to six inches.

Mr. Manning pointed out that design of these new units is completely different from similar units previously available. The nonferrous filter element is quickly removable for cleaning or replacement without the necessity for taking off screws or covers. Sturdy, foolproof snaps secure it in place and are quickly released when filter removal is necessary. The snaps are attached to the heavy steel body of the unit to prevent loss.

The body of the Series ICS Cleaner-Silencer contains a scientifically designed surge chamber to smooth the flow of intake air and remove noisy pulsation. Actual performance tests show that intake noise is effectively reduced below the general noise level.

Write Burgess-Manning Company, 749 East Park Avenue, Libertyville, Illinois, for further information.

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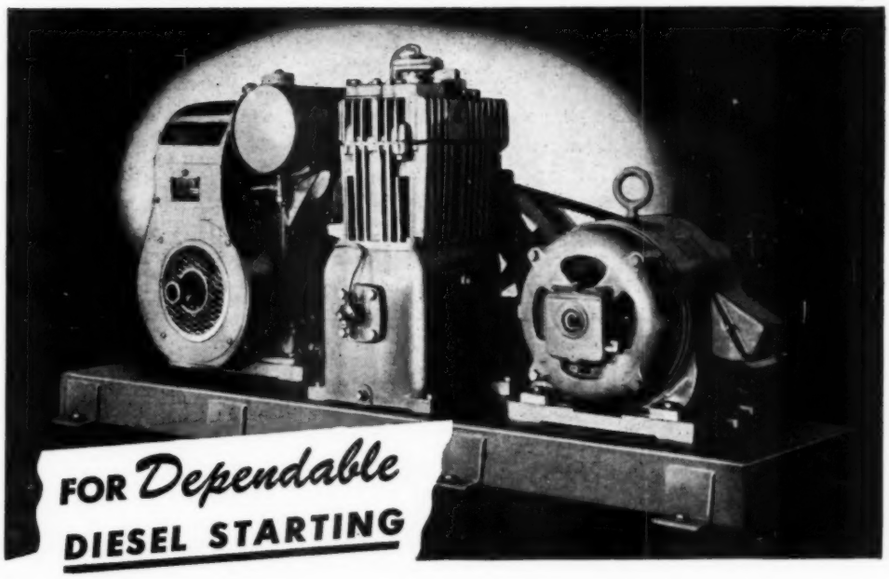


Quincy Compressors for Diesel starting air supply are available in a wide variety of models. Model D320S shown above has proved highly satisfactory as a starting unit. Compressor can be operated by either electric motor or gasoline engine. This provides standby protection against current failure — eliminates extra investment in second compressor. Quincy Compressors are available in sizes 1 to 80 cu. ft. displacement, up to 500 pounds discharge pressure. Specify Quincy Compressors for *dependable Diesel starting.*

Quincy COMPRESSORS
QUINCY COMPRESSOR CO.
Department K-116, Quincy, Illinois
Branch Offices: New York • Chicago
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THE... HELIXHAUST
WATER-COOLED MANIFOLD

**The HELIXHAUST reduces temperature of exhaust gasses—makes engine room more livable. It increases permissible supercharged rating of Diesel engines. It's simple, yet highly efficient, neater and more attractive when mounted on the engine. *It modernizes 4-cycle Diesels by turbo-charging.* Write for literature containing complete specifications on the HELIXHAUST and details on Intake Manifolds, Water Inlet Headers and Water Discharge Pipes. Stewart engineers will be glad to talk over with you further the advantages of the HELIXHAUST Water-Cooled Manifold.**

Stewart FABRICATORS OF IRON · STEEL · WIRE

THE STEWART IRON WORKS CO., Inc.
1481 Stewart Block
CINCINNATI 1...OHIO

## First Special Devices Award Goes To G.M.

THE first annual Distinguished Service Award of the Special Devices Association for outstanding accomplishment in rapid learning techniques and mass training during and since the war was recently presented to General Motors at a dinner of the association at the Special Devices Center, Office of Naval Research, Sands Point, Port Washington, L. I. The dinner was a part of the annual three-day meeting of the association, whose members are Naval Reserve officers and civilians who have served or are serving in the Special Devices Center.

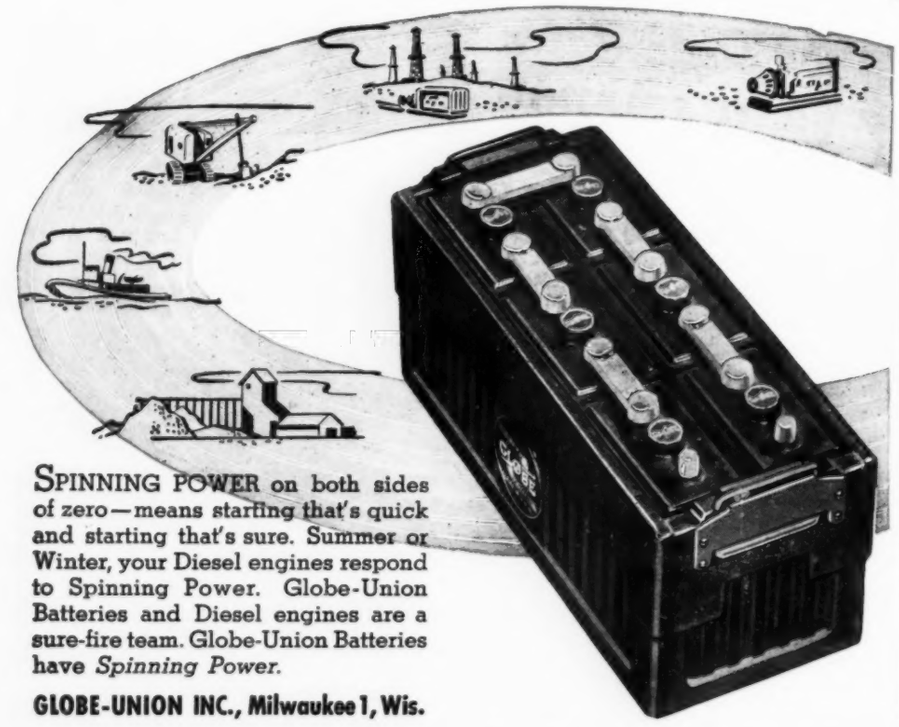
In instituting the Distinguished Service Award the association sought a means of promoting peacetime advances in the development of rapid training techniques as a measure of national preparedness. The 1947 award was presented to General Motors "for outstanding accomplishment in its scientific program involving rapid learning technique and mass training." Rear Admiral Luis de Florez, U.S.N.R., founder and first director of the Special Devices Center and later Deputy Chief of the Office of Naval Research, who is chairman of the award jury of the association, made the presentation. The certificate was accepted by C. L. McCuen, vice president of General Motors in charge of research, in behalf of the company.

C. L. McCuen (left) receives Distinguished Service Award from Rear Admiral Luis de Florez, USNR.

In making the presentation, Admiral de Florez pointed out that in every period of history the development of mankind has been limited by the ability of people to understand the teachings and put into practice the discoveries of their intellectual leaders. He said:

"This association is now holding its second annual reunion to discuss the furtherance of its objective. Since one of its prime objectives is to stimulate new development in rapid training techniques and new methods of teaching it has decided to make an annual award to industrial organizations whose scientific programs have made the greatest contribution to mass training. As a result of exhaustive study the General Motors Corporation has been selected from the nominees as the first to receive the Special Devices Award."

Mr. McCuen expressed the gratitude of General Motors on being chosen for the award and described the important part played in the war by rapid training of hundreds of thousands of men in handling the complex devices of modern war. Referring to the immediate need for this training, Mr. McCuen said: "Training was one of the elements that resulted in the enemy being overwhelmed on every front. No one service, no one organization was responsible. It was the good old American team play that

SPINNING POWER on both sides of zero—means starting that's quick and starting that's sure. Summer or Winter, your Diesel engines respond to Spinning Power. Globe-Union Batteries and Diesel engines are a sure-fire team. Globe-Union Batteries have *Spinning Power.*

GLOBE-UNION INC., Milwaukee 1, Wis.

SPINNING POWER

GLOBE-UNION

won the war. We in General Motors feel highly flattered that our small part in the job should be honored here today with the Distinguished Service Award. In response we should like to rededicate our services to the American people . . . in peace or war."

### Don Young Joins Macmillan

TAKE a Lincoln, Nebraska youth, fathered by a steam locomotive engineer, graduated from a Lincoln, Nebraska high school, mix in a little railroad roundhouse experience, send him to a California aviation and tractor trade school, throw in a dash of shipyard experience, add firing on a sea-going boat, then mix carefully with garage experience and a dash of operating donkey engines in the north woods, and you have the first layer on the experience cake of Don Young, experience that helped to qualify him as a lubrication engineer for the Macmillan Petroleum Corporation, to which position he has just been appointed.

The second layer of Young's cake of experience started with several years at Lockheed Aircraft Corporation, beginning in 1927 when the production line consisted of one plane at a time, turned out by twenty or thirty mechanics, and ended with several exciting and interesting years as director and builder of Roscoe Turner's record-shattering airplanes and transport pioneers. This team has the distinction of being the only one to win three Thompson trophies, and much of their success is attributed to Young's research, design and creative ability. A short stint as Lockheed service manager at Dayton, Ohio, was followed by his recall to the main office at Burbank, California, where he was named director of all field and service representatives, both domestic and foreign. He recently joined the engineering staff of the Macmillan Petroleum Corporation where his ability and wide experience will be devoted to helping solve lubrication problems of truck fleet owners throughout the United States.

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ON THE RAILS OR ON THE ROAD

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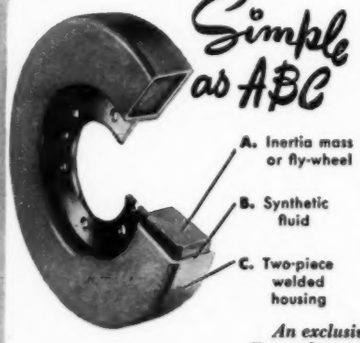


● There are only two essential parts to the Houdaille Viscous Torsional Vibration Damper . . . the housing and inertia mass or fly-wheel. Since the housing is hermetically sealed and there are no wearing parts, there is no service, replacement or repair problem. Temperature does not materially influence the damper's efficiency because of the relatively flat viscosity curve of the fluid used.

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## Graham Appointed Sales Manager of Fairbanks-Morse Railroad Division

V. H. PETERSON, Manager of the Railroad Division of Fairbanks, Morse & Co., announces the appointment of James G. Graham as Sales Manager of the Division. Jim, as he is most generally known by his many friends in the railroad industry, joined the Fairbanks-Morse organization about a year and a half ago as District Manager of the Railroad Division of the company with headquarters in Chicago. His recent promotion, therefore, is good news to his many friends in the Chicago area. He will continue to have his headquarters in the company's main office at 600 South Michigan Avenue.

## New Multifuel Engine

New White-Roth multifuel engine

A NEW line of heavy-duty single cylinder horizontal, two-cycle, multi-fuel engines is announced by White-Roth Machine Corporation, Lorain, Ohio. The first model, known as Lorain Type L, is now in production. It will operate on Diesel fuel, natural gas or butane. When burning Diesel fuel the engine is equipped to operate on the Diseel cycle as a compression-ignition cold starting engine.

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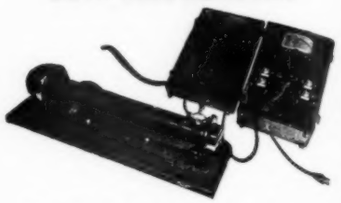

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and 21.4 hp. @ 600 rpm. It has a 7½ in. bore and 8 in. stroke with Timken bearings on crankshaft and crosshaft. "Wet" cylinder liners can be replaced in the field.

Condenser type cooling system eliminates need for water pump and makeup water is negligible. Standard equipment includes Twin Disc Clutch, Pierce Governor, Air Maze oil bath type cleaner, McCord Lubricator. Radiator, fan, V-belts, sparkplug and magneto are enclosed in metal guards. Over-all dimensions are: height, 52½ in.; length, 70 in.; width, 47¼ in. Shipping weight is 2500 pounds.

### Enterprise Head Retires

CHARLES S. HOEHN, a name long associated with the Diesel Engine Industry, has announced his retirement as President of Enterprise Engine and Foundry Company of San Francisco. Starting as an apprentice with Enterprise 57 years ago Mr. Koehn rose to the Presidency of the company, which position he has held for the past 30 years. During his extended term in office Mr. Hoehn was connected with the design and development of numerous industrial products, which included Oil Burners and a diversified line of Process Machinery, in addition to the basic Enterprise line of heavy duty Diesel Engines. While his retirement will relieve him of active duties as the head of the company, Mr. Hoehn will continue to serve on the Board of Directors and in a special consulting capacity.

Charles S. Hoehn


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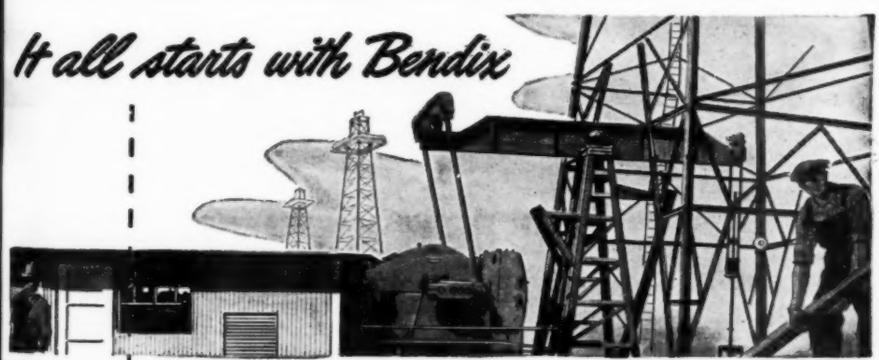

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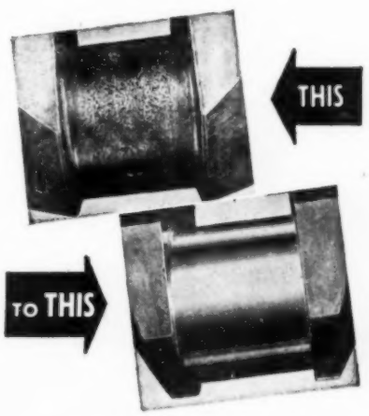


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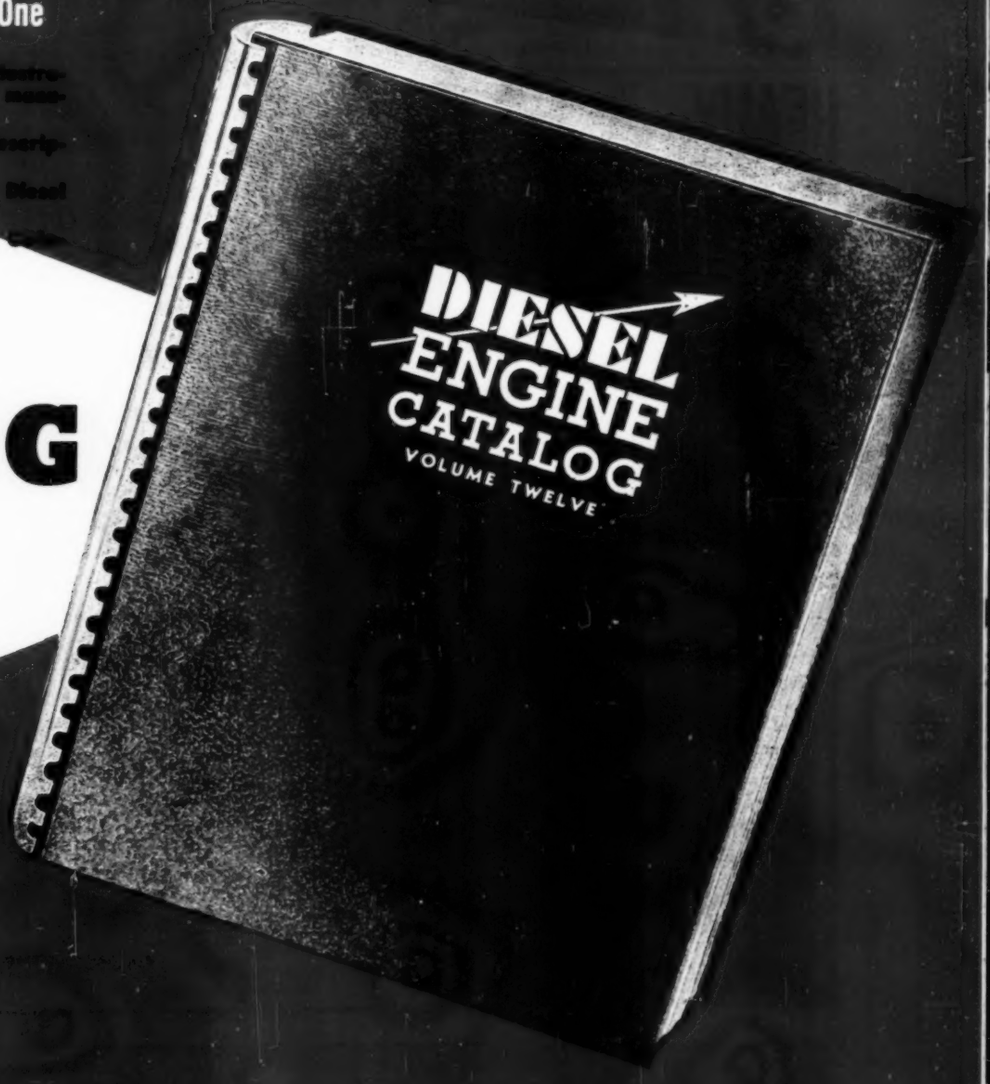


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## The Modern Diesel

COL. Oliver Field Allen's new book "The Modern Diesel" has just been published. It fills a long-felt need for a comprehensive, non-technical review of what the Diesel engine is, where it has come and where it is going. Dr. Alexander Klemin, writing to the author, said: ". . . The book is wonderfully good. . . . What impresses me is that you have, without a single formula, made principles crystal clear. There is not an interested layman (much less an engineer) who will fail to understand exactly what Diesel means . . ."

There are twenty-four chapters, starting with an historical background, going through the various types of Diesels, then to injection systems, supercharging, applications, and closing with "The Economics of Power" and future trends. The text is enlivened and clarified with 185 illustrations. All in all a comprehensive work published by Prentice-Hall. Price $5.00.

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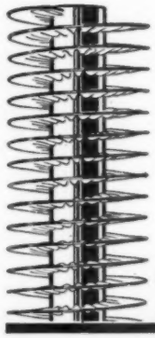

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## West Coast Diesel News

*By* FRED M. BURT

THE *Isabella Stewart,* 74 ft. long, powered with a 400 shp. Atlas Imperial Diesel; 128 ft. *Florence Filberg,* two 600 shp. Fairbanks-Morse Diesels; and 128 ft. *Mary Mackin,* two 690 shp. F-M Diesels; are new tugboats acquired by Canadian Tugboat Co., from U. S. Maritime Commission for use along the east coast of Vancouver Island.

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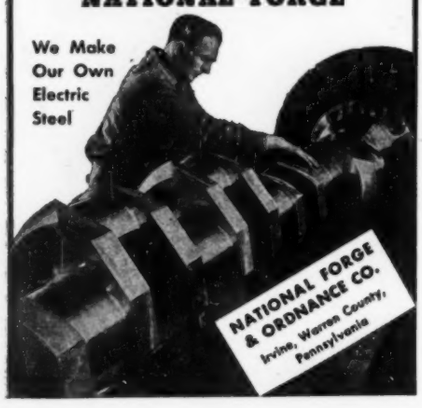


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TWO research vessels for U. S. Fish & Wildlife Service, sailing for three-year stay in Philippines, are former 143 ft. AMc-90 converted to the *Theodore N. Gill,* with Diesel-electric power including twin 900 hp. G.M. engines, and ex-LT-581, renamed *Spencer F. Baird,* 97 footer, with 450 hp. Hamilton Diesel.

PACIFIC Coast Eng'g Co., Alameda, Calif., has $871,700 contract from U. S. Bureau of Reclamation for 130 ft. dredge for use on Colorado River, to have 1350 hp. Enterprise Diesel engine; also a twin screw work boat with two 90 hp. Sterling Diesel engines.

THE former YP-206, converted to hook-and-line clipper at Martinolich Shipbuilding Co., San Diego, for Sun Harbor Packing Co., and skipper-part owner, Tony Oliviera, has for propulsion a 550 hp. Union Diesel; a pair of 220 hp. Unions turning 125 kw. generators as auxiliaries.

NINETY-TWO ft. wood purse seiner *Sea Rover II,* with 520 hp. 8 cyl. Enterprise Diesel and pair of 75 kw. Enterprise generating sets, is being built at Harbor Boat Building Co., Terminal Island, for Vince Smith, San Pedro, to fish for South Coast Fisheries, Inc., designed by Myles Rados.

A "CATERPILLAR" Diesel, purchased from Thomas A. Short Co., San Francisco, along with Pacific Western marine gear, with 2-1 reduction, is going into combination boat being built at Eureka for Diego Arancio.

NEW combination boat *Sea Bird,* built by Genoa Boat Works, Fishermen's Wharf, San Francisco, for Nuncio Tarantino and Al La-Rocca, is powered with a 165 hp. General Motors Diesel.

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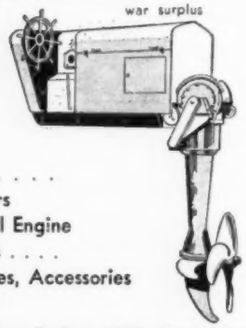

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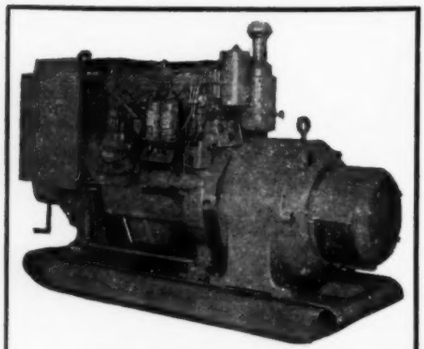

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